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# General Certificate of Education **Design and Technology:** **Product Design 3D**

PROD3

Mark scheme

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2550

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Answer three questions, one from each of sections 1 and 2 and one other question from either section.

Section 1

Question 1

Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	01		<ul style="list-style-type: none"> <li>• 4 x 1 mark allowed for accurate name of specific material combined with a relevant application (both must be stated accurately for mark.)</li> <li>• 4 x 6 marks available for explanation of appropriate use (<i>Mark relevant points and explanations.</i>)</li> <li>• <i>Use of diagrams may be seen as explanation of a point.</i></li> <li>• <i>No mark award for definition of material category e.g thermoplastics are...</i></li> <li>• <i>If a candidate puts a material in the wrong category then <b>3 marks max</b> can be awarded.</i></li> <li>• <i>If a bullet pointed list is used with limited explanation of points then <b>4 marks max</b></i></li> </ul> <p><b>Possible Examples:</b></p> <p><b><u>Ferrous metal:</u></b>  <b>Mild Steel is used in the production of car body panels.</b> The material is suitable for this as it is <b>malleable under large pressure, making press forming of the parts a viable production method.</b> It is available in a wide range of stock sizes and is <b>easily joined by Spot and MIG welding.</b> The material can be treated by <b>Galvanising to prevent corrosion</b> and if the panel suffers an impact from a collision, <b>although the material will deform it's malleability will reduce the chance of splitting and protect the occupants inside more than a polymer alternative.</b></p> <p><b><u>Non-ferrous metal:</u></b>  <b>Copper is used in the production of electrical wiring,</b> the material is extremely suitable for this application due to having <b>excellent electrical conductivity,</b> this <b>improves the efficiency of the wiring.</b> Another important factor is that Copper is <b>extremely ductile,</b> meaning it <b>can be drawn into a wire without fracture.</b> This is <b>essential in the production of cabling where strands can have cross sections of 1mm<sup>2</sup> and be in excess of 10 metres long.</b></p>	28	<p><b>QWC: there is no specific mark award for QWC. To assess this you should mark each question and if errors in spelling and grammar are sufficient subtract a maximum of 1 mark per question where the errors are found.</b></p> <p><b>(4x7 marks)</b>  <b>Use the bands as secondary guidance</b></p> <p><b>0-3 marks</b>  Material or application may not be stated or suitable. Properties listed (not explained) but not always relevant.</p> <p><b>4-5 marks</b>  Material and application stated are suitable. Relevant properties listed and some justification for why these are required.</p> <p><b>6-7 marks</b>  Material and application stated are suitable. Relevant properties listed and justified for why these are required.</p>

		<p><b><u>Hardwood:</u></b>  <b>Teak is used in the production of outside furniture.</b> It is suitable for this application due to several reasons. Firstly, <b>although it needs treating regularly with Teak oil</b>, it has a <b>natural resistance to weathering and external environmental conditions.</b> Further to this it is <b>resistant to acid</b>, and <b>although it should not come into contact with neat acids the presence of ‘acid rain’ in some locations makes it ideal.</b> As a hardwood it can be prohibitively expensive, but <b>its dark appealing aesthetics and long knot free sections make it ideal for small batch produced furniture aimed at the higher price bracket of exterior furniture.</b></p> <p><b><u>Thermoplastic:</u></b>  <b>ABS is used in the production of many electronic product casings, such as mobile phones.</b> It is a suitable material for this application as it can be <b>injection moulded</b>, allowing the production of <b>complex 3D forms with varying wall thicknesses.</b> Due to its <b>toughness</b> it is <b>resistant to the impacts associated with dropping mobile phones.</b> It is <b>available in a wide range of colours</b> allowing the <b>product range to be expanded</b> and appeal to a wider range of consumers.  <b>The pigment giving the colour to the polymer is full-depth</b>, meaning and scratches on the surface of the product will not affect the overall aesthetics of the product.</p> <p><b><u>Thermosetting plastic:</u></b>  <b>Urea Formaldehyde is used in the production of electrical plug sockets.</b> As a thermosetting polymer it will <b>not melt when subjected to heat</b>, it may degrade but the essential property in this situation is <b>resistance to deformation in the event of an electrical fire/spark</b>, as this will prevent the <b>exposure of live wires to human contact.</b> Also <b>its high electrical insulation value</b> means it is <b>ideal to house wires carrying currents associated with devices fitted with 13 Amp fuses.</b></p>		
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**Question 2**

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	02		<ul style="list-style-type: none"> <li>• The question requires candidates to discuss issues related to sustainability using two different products to explain their understanding. If only one product is used the mark is capped to 14 marks.</li> <li>• The initial statement refers to natural resources, energy and pollution, but if candidates do not refer to all of these equally their marks should not be affected.</li> <li>• The naming of a specific product does not have a mark associated with it as it is seen as a vehicle to answer the question.</li> <li>• The strength of the product choice may affect the number of points and detail possible in the answer.</li> <li>• If the two products selected overlap then marks should only be awarded for new points and repetition should be highlighted, but not credited.</li> <li>• The presentation of this answer is expected to be in essay format, but a Life Cycle Assessment diagram with relevant annotations should not be penalised.</li> </ul> <hr/> <p><b>Possible example</b></p> <p><b><u>Washing Machine:</u></b> Possible points that may be made are shown below in a bullet pointed list, as for all questions the making of a clear relevant point is worthy of one mark and further detailed explanation that contextualises the point made will add a second mark.</p> <ul style="list-style-type: none"> <li>• Use of press formed mild steel requiring high level of energy in forming process</li> <li>• Recycling of mild steel sheet reduces the impact on natural resources. (this requires efficient waste separation at 'tip/dump', this is also reliant on the public being conscientious)</li> <li>• Some electrical retailers will take away old white goods upon the purchase of a new product, thus reducing fly tipping and improving recycling rate.</li> <li>• The front panels of washing machines are mainly made from thermoplastics formed by a range of redistribution methods. These require less energy to form due to the melting point of thermoplastics being far lower than that of metals. <i>(second mark awarded only due to comparison with metal equivalent)</i></li> <li>• Unfortunately due to the use of crude oil (a non-renewable/finite resource) in the production of</li> </ul>	28	<p><b>(2x14 marks)</b> <b>Use the bands as secondary guidance</b></p> <p><b>0-6 marks</b> Points made, but these lack explanation or technical detail.</p> <p><b>7-10 marks</b> Points are made and some explanation/technical detail has been given to enhance the answer</p> <p><b>11-14 marks</b> Points are made and explained using technical terms and justifications</p>

		<p>thermoplastics this is not sustainable.</p> <ul style="list-style-type: none"> <li>• Manufacturers can improve the recycling of these products by using temporary fixing, such as screws, or bolts to aid dis-assembly. They may also reduce the number of components required by using integrated fixings formed during injection moulding.</li> <li>• During use a washing machine uses the majority of its energy and so designers are constantly developing ways to reduce this. The removal of the hot water feed from modern washing machines means that water is now heated to the required temperature by the machine itself reducing energy used per wash.</li> <li>• The development of energy efficiency ratings enables consumers to judge a product before purchase, based on its efficiency.</li> <li>• Developments in detergent technology mean that washing can be undertaken at much lower temperatures (15°C in some cases) reducing energy use even further.</li> </ul> <p><b>Other possible points may refer to:</b>  <b>Natural resources:</b> finite/ non-finite low impact materials  <b>Energy use:</b> In both attaining raw materials and processing/conversion.  <b>Pollution:</b> In manufacture of material/product, product in use and disposal  Reduce, recycle, reuse, biodegradability, optimisation, eco-design</p>		
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**Question 3**

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	03		<ul style="list-style-type: none"> <li>• The use of diagrams/sketches should be credited if they enhance the answer by explaining a point made, but not if they just redraw the existing images on the insert sheet. <b>(if an image is redrawn and annotated to show how points in the answer refer to the product then credit may be given (1 mark))</b></li> <li>• Some of the notes below are not evident from the photographs on the insert sheet and so we cannot expect candidates to deduce these, although if made they will receive credit,</li> <li>• Consider whether the point made could be true if going on evidence of the photographs only.</li> <li>• Accept Stainless steel as material.</li> </ul> <hr/> <p><b><u>Lemon Squeezers:</u></b></p> <ul style="list-style-type: none"> <li>• 1 mark awarded for recognising the Juici Salif or Philippe Starck as the designer no second mark for both pieces of information</li> </ul> <p><b><u>Juici Salif</u></b></p> <ul style="list-style-type: none"> <li>• The Juici Salif is a classic Philippe Starck product where the function of the product is secondary to the aesthetics, in complete opposition to the Bauhaus ‘form follows function’ this is a study of form over function.</li> <li>• The design allegedly came from an incident when Philippe Starck was eating squid in a restaurant and squeezing lemon over his meal, this inspired the tentacle like legs emanating from the solid juicing head.</li> </ul> <p><b><u>Functional Limitations:</u></b></p> <ul style="list-style-type: none"> <li>• The juicer is unstable during use and liable to tip while juicing unless held by the leg, this is due to the high centre of mass caused by the solid cast juicing head.</li> <li>• The use of die cast aluminium gives an aesthetically pleasing finish to the product, however the fact that aluminium reacts with citric acid (present, surprisingly, in citrus fruits) means that the surface can become tarnished with a white oxide layer. This is most evident between the ridges on the juicer towards the lower point, where cleaning is trickiest.</li> <li>• The design has no method of catching the juice and so a glass, or bowl must be stood under the main body.</li> <li>• Separating the pips is another problem as there is no method other than adding a tea strainer, or such like above the glass/bowl.</li> <li>• The pips can get trapped in the grooves when</li> </ul>	28	<p><b>(2x14 marks)</b></p> <ul style="list-style-type: none"> <li>• Candidates may talk separately about each product, or in one combined response, either method is fine.</li> <li>• The question mentions function, aesthetics and the influence on design and use of materials. Candidates do not have to cover these equally and may not highlight the coverage in their answer.</li> <li>• (if only one product is analysed marks are capped to 14)</li> </ul> <p><b>Use the bands as secondary guidance.</b></p> <p><b>0-6 marks</b> Points made are not explained or justified.</p> <p><b>7-10 marks</b> Some points have added detail and justification.</p> <p><b>11-14 marks</b> Points are explained and views are justified.</p>

			<p>flowing down the body of the juicer, but this is not a guaranteed method of straining.</p> <ul style="list-style-type: none"> <li>The size of the juicing head is perfect for a lemon, but for larger fruits, such as oranges only the centre of the fruit is juiced and the juicing action must be adjusted to complete the operation.</li> </ul> <p><b><u>Other functional aspects</u></b></p> <ul style="list-style-type: none"> <li>The base of each leg has a small firm rubber foot attached to prevent scratching surfaces.</li> </ul> <p><b><u>Aesthetic features</u></b></p> <ul style="list-style-type: none"> <li>The shape of the legs, specifically the fact they exit the body at an upward angle prevents juice from flowing down the legs due to gravity.</li> <li>The narrow cross section of the three legs gives a central spine on each, which is an ideal position to hide the split lines for the multi-piece casting mould used in production.</li> <li>The Alessi logo has been added with in mould decoration along one of the three legs as a subtle.</li> <li>The Juici Salif is available in a range of finishes, including a gold plated version, which due to the inert nature of the finish will resist the citric acid already mentioned.</li> </ul> <p><b><u>Thermoplastic Lemon squeezer:</u></b></p> <ul style="list-style-type: none"> <li>The lemon squeezer has been produced from injection moulded polypropylene</li> <li>The use of polypropylene aids the function of the product due to its chemical resistance (it doesn't react to citric acid)</li> <li>Polypropylene is suitable for use in a dishwasher without deformation occurring.</li> <li>Polypropylene flows well through narrow sections in moulding, allowing the pip strainer to be formed accurately.</li> <li>The work fatigue resistance of polypropylene means that the thin nature of the thermoplastic should stand up to the repeated stress cycles associated with vigorous juicing and pressure being applied to the centre section.</li> <li>Polypropylene is available in a range of colours enabling the product to appeal to a wide range of consumers no matter what colour their kitchen is.</li> <li>The compact nature of the product means there is a low centre of mass and that during use the product will remain stable.</li> <li>The pip strainer is removable for ease of cleaning</li> <li>Removal of the strainer also means cleaning can take place after juicing each piece of fruit, keeping the straining holes unclogged.</li> </ul>	
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		<ul style="list-style-type: none"> <li>• The central juicing section is large enough for large citrus fruits, such as oranges.</li> <li>• The design uses integral fixings to clip the two components together, thus reducing manufacturing time and aiding recycling as all parts are made of the same material.</li> <li>• The juice tray has a spout to pour the juice into a glass once finished.</li> </ul> <hr/> <p><b><u>Cork screws:</u></b></p> <ul style="list-style-type: none"> <li>• 1 mark awarded for recognising the Anna G or Alessandro Mendini as the designer no second mark for both pieces of information.</li> </ul> <p><b><u>Anna G</u></b></p> <ul style="list-style-type: none"> <li>• The Anna G is a classic Alessi product designed by Alessandro Mendini</li> <li>• Constructed from an injection moulded/polyamide body and three main die cast/Zinc Alloy (Zamak) components, which have been chrome plated for the final appearance.</li> <li>• The injection moulded body is sculpted to look like a flowing skirt.</li> <li>• The polyamide is available in a wide range of colours to suit a range of customers.</li> <li>• The external surface has been textured during moulding, this gives a matte surface which will hide imperfections/scratches longer than a glossy finish, thus increasing the longevity of the product.</li> <li>• The Polyamide has a low coefficient of friction meaning that the joint with the Zamak arms will hopefully move freely throughout its life.</li> <li>• The Polyamide is also resistance to chemicals and acids, such as those contained in wine.</li> <li>• The head design doubles as a handle to screw the corkscrew into the cork and the arms rise simultaneously to the sides.</li> <li>• The use of two levers keeps pressure on the middle of the bottle and increases stability as the cork is removed, this could be easily done on a table or worktop.</li> <li>• To remove the cork from the corkscrew there are four ridges under the injection moulded dress which grip the cork as you turn the head this prevents the cork from turning with the corkscrew and releases it from the thread.</li> <li>• No brand label is present on the Anna G as the quirky aesthetic form shown is synonymous with Alessi .</li> </ul> <p><b><u>Le Creuset Corkscrew:</u></b></p> <ul style="list-style-type: none"> <li>• A stainless steel construction with an overmoulded thermoplastic grip.</li> <li>• Operated by a single lever mechanism which</li> </ul>		
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			<p>requires the bottle to be steadied while removing the cork.</p> <ul style="list-style-type: none"> <li>• Manufactured from several stainless steel plates which have been rolled and stamped to shape, before being connected with two rivet pivots for the corkscrew and fulcrum about which the handle rotates.</li> <li>• The product has a brushed finish on the stainless steel with a in mould texture applied to the thermoplastic overmoulding.</li> <li>• The product has had a simple instructive symbol stamped onto it during the original sheet stamping process to aid operation.</li> <li>• The branding has been applied in a similar way, reducing additional processes associated with adding logos to product s.</li> <li>• By stamping the logo into the product it will never fade and so will continue to advertise the company throughout its life.</li> </ul> <p>The use of rolled stainless steel sheet rather than cast sections is essential in a product which will be subjected to leverage forces, as a cast section is liable to crack during operation.</p>		
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**Section 2**

**Question 4**

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	04		<ul style="list-style-type: none"> <li>• 1 mark - for naming a specific product.</li> <li>• up to 3 marks (max.) for accurate drawing of product with annotation</li> <li>• The choice of product will affect the depth and quality of the answer.</li> <li>• As with all questions marks should be awarded for relevant points and if supported with clear concise explanations further credit awarded.</li> </ul> <p>Interpretation of this question may be varied, some guidance is shown below The statement may suggest to students that an electronic product would be an ideal choice for a relevant product, due to the internal components if so:</p> <p><b><u>Iphone:</u></b></p> <ul style="list-style-type: none"> <li>• Touchscreen technology requires a large flat surface, thus giving the iphone its large user interface.</li> <li>• The playing of videos in the device has affected the proportions of the screen and may possibly be why the Iphone 5 has diverted further from the golden rectangle proportions of earlier Ipods.</li> <li>• The internal aerial has changed the detailing on the external casing</li> <li>• Internal MP3 player requires an external jack socket, positioning of which has to be considered.</li> </ul> <p><b>Some candidates may recognise the statement as coming from James Dyson and therefore reference one of the Dyson vacuum cleaners:</b></p> <ul style="list-style-type: none"> <li>• The external form mimics the internal technology allowing users to follow the progress of the dust through the cleaner.</li> <li>• This increases their confidence in the product as they are able to maintain the cleaner easily due to clear points along the dust path where access can be gained to remove blockages.</li> <li>• The clear waste bin means that users can see the cyclone working and tell when the product needs emptying.</li> <li>• By making the cyclones visible it is clear to customers the differences/improvements when a new model appears e.g the DC07 had 7 visible cyclone cones compared to the single</li> </ul>	10	<p><b>(10 marks)</b> <b>Use the bands below once you have marked all relevant points on a question as a final tool only if you are unsure.</b></p> <p><b>0-4 marks</b> Product choice may not be specific e.g TV, mobile phone etc. This will lead to generic points with little room for explanation.</p> <p><b>5-7 marks</b> The choice of product will be more specific and points made will be explained/justified.</p> <p><b>8-10 marks</b> A specific product has been selected with well-reasoned views expressed covering different feature/aspects of the product</p>

			cyclone on the DC01. (diagram would be useful here) <b>Other candidates may relate the statement to 'form follows function' and use a Bauhaus product as an example, this should also be accepted.</b>		
4	05		Candidates may refer to their own coursework projects to answer this question, the question doesn't require them to address all three bullet points equally, but if one is not mentioned their maximum mark should be restricted to 12 marks. The lists below are again not exhaustive, but included for guidance.  <b><u>Development of a design proposal:</u></b> <ul style="list-style-type: none"> <li>• Use of focus groups to gain feedback at regular stages.</li> <li>• Reference to PDS (Product Design Specification) to ensure design meets criteria</li> <li>• Use of initial card/foam etc. modelling to make visual representations of concept to be used at focus groups and interviews with client.</li> <li>• Construction of CAD model to use for virtual testing against criteria in specification.</li> <li>• Generation of dimensioned working drawings to liaise with manufacturer/technical specialist and modify accordingly.</li> </ul> <b><u>Prototype manufacture:</u></b> <ul style="list-style-type: none"> <li>• Use of rapid prototyping in conjunction with 3D CAD model to test :                         <ul style="list-style-type: none"> <li>○ aesthetics with focus group</li> <li>○ manufacturing potential with technical specialists</li> <li>○ functionality of product</li> </ul> </li> <li>• The use of working prototypes allows testing of the CAD file before manufacture of expensive moulding machinery for the final production run.</li> </ul> <b><u>Evaluation and Appraisal:</u></b> <ul style="list-style-type: none"> <li>• Evaluation is used throughout the design and manufacture process to improve Quality Assurance</li> </ul> Use of third party feedback to gain views of possible consumers	18	(18 marks) <b>Use the bands below once you have marked all relevant points on a question as a final tool only if you are unsure.</b>  <b>0-8 marks</b> Points made lack explanation, only one of the bullet points may have been addressed.  <b>9-13 marks</b> Points are contextualised, but technical detail is limited.  <b>14-18 marks</b> Contextualised points are made clearly and using relevant technical language.

**Question 5**

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	06		<ul style="list-style-type: none"> <li>• 4 x 1 mark awarded for appropriate applied finishes.  <i>The use of generic terms such as paint,</i></li> </ul>	28	<b>(4x7 marks)</b> <b>Use the bands as secondary guidance.</b>

		<p><i>varnish, oil etc. should not be accepted, candidates should be specific using terms such as water-based acrylic paint, polyurethane varnish, or Danish oil etc.</i></p> <ul style="list-style-type: none"> <li>• <i>If finish is not specific e.g paint candidates can still access full application and purpose marks.</i></li> <li>• <i>4 x 1 mark for appropriate application e.g car body panels etc.</i></li> <li>• <i>4 x 6 marks to be divided between application of finish and purpose, although this may not be equally weighted.</i> <i>A maximum of 4 marks are available for the application of the finish and 4 marks for the purpose of the finish (to total no more than 6 marks when combined).</i></li> <li>• <i>Diagrams should be credited if they add to the answer and explain the process.</i></li> </ul> <p><b>NO MARK AWARD FOR APPLICATION BY: BRUSH, ROLLER OR SPRAY UNLESS SUPPORTED BY FURTHER EXPLANATION.</b></p> <p>Four different finishes are required for the materials shown, if duplication is seen credit the finish if appropriate but the description can only be credited for on material. Some possible finishes for each material:</p> <ul style="list-style-type: none"> <li>• <b>Aluminium sheet:</b> anodising, powder coating</li> <li>• <b>P.S.E softwood:</b> tanalising, polyurethane varnish, Danish oil, etc.</li> <li>• <b>Mild steel tube:</b> electro-plating (including chrome-plating, tin-plating etc.), dip coating, powder coating, galvanising, sherardising etc.</li> <li>• <b>MDF Sheet:</b> paint (specific), lamination (veneer/melamine formaldehyde/etc.)</li> </ul> <hr/> <p><b>Example:</b> Anodising is an electrochemical process that forms a protective coating of aluminium oxide on the surface of the aluminium. <i>(Diagrams or further description would be needed to expand explanation of process)</i></p> <ul style="list-style-type: none"> <li>• <i>Raw aluminium left exposed will corrode and oxidise and become unsightly.</i></li> <li>• <i>Anodising protects the raw aluminium, transforming it into a hard and durable weather resistant surface.</i></li> </ul> <p><i>Colours and other additives can also be used to enhance the finish.</i></p>	<p><b>0-3 marks</b> Finish is stated, detail of application process and purpose is limited (no relevant diagram)</p> <p><b>4-5 marks</b> Finish is stated, detail of application process and purpose shows some technical understanding (diagrams may be included but depth of explanation may be sufficient for mark)</p> <p><b>6-7 marks</b> Finish is stated, detail of application process and purpose shows technical understanding (diagrams add detail and clarify points)</p>
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**Question 6**

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	07		<ul style="list-style-type: none"> <li>• The question requires candidates to compare Fabrication and Redistribution as general processing methods, the lists below give some possible points that may be made, these may be related to specific processes, and if this is done accurately credit should be given.</li> <li>• If specific processes, such as blow moulding, injection moulding etc. are listed this is worthy of a single mark only.</li> <li>• Descriptions of these processes with diagrams will not be accepted as mark worthy, unless they are used to explain advantages or disadvantages of the two methods stated in the question. If they are supportive then only a single mark is available for the description and diagram combined.</li> </ul> <hr/> <p><b>Fabrication:</b></p> <p><b>Advantages</b></p> <ul style="list-style-type: none"> <li>• Large structures can be assembled on site</li> <li>• Assembly method can be permanent or temporary</li> <li>• Materials to be joined do not have to be the same.</li> <li>• Varying thicknesses and cross sections can be joined</li> <li>• Some fabrication methods can be used as aesthetically pleasing features, such as wood joints <i>(a supporting diagram of a dovetail joint would gain credit here, although if more than one joint shown only 1 mark is awarded for sketches in total)</i></li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>• Strength of joint is often weaker than the rest of the material, for example soldering</li> <li>• Temporary joints such as screws, bolts etc. can weaken material where inserted.</li> <li>• If joining timber use of metallic components can lead to degradation in certain environments</li> <li>• If different materials are joined their differing physical properties, such as thermal expansion rates, could cause problems.</li> <li>• Some permanent joining methods, such as welding and brazing require secondary wastage processes, such as grinding to improve the aesthetic appearance of the joint.</li> </ul> <p><b>Redistribution:</b></p> <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Complex 3D forms can be created in a single piece.</li> <li>• In mould detailing can be applied, along with texture to improve aesthetics.</li> </ul>	28	<p><b>(28 marks)</b> <b>Use the bands as secondary guidance</b></p> <p><b>0-12 marks</b> Candidates refer to the methods making points with limited reference to a context/situation where this advantage/disadvantage is evident.</p> <p><b>13-20 marks</b> Candidates make relevant technical points with a degree of explanation on most points.</p> <p><b>21-28 marks</b> Candidates accurately identify relevant technical issues related to the methods using real examples to contextualise the points made throughout.</p> <p>(Candidates who refer to forming processes, such as drop forging should be credited for relevant points due to the cross over between deformation and redistribution in the specification)</p>

		<ul style="list-style-type: none"> <li>• Texture can improve wear resistance of product as scratches are less evident on matte surfaces.</li> <li>• Varying wall thicknesses can be achieved using some processes, such as injection moulding*.</li> <li>• Integral fixings can be included to join components and reduce use of screws, bolts etc.**</li> <li>• Hollow objects can be produced in a single piece.</li> <li>• The deformation of metal through forging and press forming maintains the internal structure and in some cases can strengthen the material through work hardening.</li> </ul> <p>*If reference is made to a specific process that demonstrates the point made then a second mark should be given.</p> <p>**If explanation is given as to how the point made improves manufacturing, efficient or recycling a second mark should be awarded.</p> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• The redistribution of metals using casting affects the internal structure of the material and weakens it.</li> <li>• Varying wall thicknesses in injection moulding and casting can lead to sink marks appearing on surfaces of products and affecting the aesthetics. This can be combatted with textured surfaces to reduce the evidence of these marks.</li> </ul> <p>Initial set up costs of the tooling for these processes is high and manufacture of the moulds can require complex machining processes, such as EDM (Electrical Discharge Machining)</p>		
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