



**General Certificate of Education (A-level)**  
**June 2011**

**Design and Technology:**  
**Product Design**

**PROD3**

**(Specification 2550)**

**Unit 3: Design and Manufacture**

**Post-Standardisation**

***Mark Scheme***

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NB. This mark scheme is intended as a guide to the type of answer expected but it is not intended to be exhaustive or prescriptive. If candidates offer other answers which are equally valid they must be given full credit. Many responses at this level are assessed according to the quality of the work as well as the number of points included.

The following level descriptors are intended to be a guide when assessing the quality of a candidate's response.

<b>Low:</b>	The candidate has a basic but possibly confused grasp of the issues. Few correct examples are given to illustrate points made.
<b>Intermediate:</b>	The candidate does not have a clear idea of what s/he is writing about. The candidate has some knowledge but there is limited clarity of understanding. Some correct examples given to illustrate points made.
<b>High:</b>	The candidate knows what s/he is writing about but there is some confusion. The candidate has a thorough understanding of the issues and has provided relevant examples to support the knowledge shown. The candidate knows what s/he is writing about and provides clear evidence of understanding.

Question	Item	Marking Guidance	Mark	Comments
1	01	<p><b>Eames Lounge Chair 1956</b></p> <p>The design is considered to be one of the first to make use of moulded plywood, a technique devised during WW II for leg and arm splints, for furniture construction. The chair makes use of luxurious materials such as rosewood faced plywood, cast aluminium and leather to create organic shaped seating shells and the process of “cycle welding” which enabled them to join wood to leather/glass/metal etc.</p> <p>Candidates may not have explicit knowledge of the chair and detail above but should be aware of lamination, metal forming etc and how they can be employed to generate the shapes required.</p> <p>Comments and judgements with regard to the aesthetics may be personal to the candidate and again may not recognise that the product is considered to be an iconic/classic design.</p> <p>N.B. Candidates may not divide their answer <b>equally</b> between aspects of both “form and aesthetics”, as stated in the question, but both aspects should be included in the answer.</p> <p><b>Barcelona Chair 1929 designed by Mies van der Rohe and Lilly Reich ( Bauhaus student )</b></p> <p>Designed for the German Pavilion at the 1929 Exposición Internacional de Barcelona – a landmark of the “modern movement” the chairs were intended to be thrones for the Spanish King and Queen. The chair consists of an X frame made of two flat bars of steel either chrome plated or stainless steel, providing both practical/ protective and an attractive finish. The X is associated with medieval royal chairs and as a result of the Barcelona chair, the first accepted use of metal in luxury furniture. The</p>	14	<p><b>Low:</b> Simple statements, which show weak/poor understanding of the materials/processes involved and/or aesthetics. <b>(0 – 4 marks)</b></p> <p><b>Inter:</b> Shows understanding but lacks detail. Generalised statements with minor factors or few points made. <b>(5 – 9 marks)</b></p> <p><b>High:</b> Wide and varied range of methods described with both detail and depth of understanding. <b>(10 – 14 marks)</b></p>

			<p>frame is forged, but accept welding as a viable alternative construction method. The cushion support is upon leather straps with Pirrelli webbing as alternative. The cushions are buttoned leather for practical as well as aesthetic purposes. Mass produced by Knoll in America from 1950's.</p> <p>Recognise the use of industrial / modern materials in furniture design. Forged mild steel (chrome plated) or polished stainless steel is used to contrast with the black leather seat. Forging induces spring steel properties to add flexibility and comfort to chair (original 1929 design bolted together but product re-designed in 50's for forging).</p>		
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Question	Part		Marking Guidance	Mark	Comments
<b>2</b>	<b>02</b>		<p>Explanations should show candidates appreciate difference between anthropometrics, body sizes / 95<sup>th</sup> percentiles and ergonomics, interaction between humans and product/environment.</p> <ul style="list-style-type: none"> <li>Kitchen – should make reference to working triangle: <ul style="list-style-type: none"> <li>Food storage</li> <li>to Food preparation</li> <li>to sink/washing</li> <li>to cooking</li> <li>to serving</li> </ul> </li> </ul> <p>also – Lighting / worktops / storage / equipment / hygiene etc.</p> <ul style="list-style-type: none"> <li>Car interior – making reference to: <ul style="list-style-type: none"> <li>Seat adjustment</li> <li>Dashboard layout / controls / display / ideograms – symbols – colour</li> <li>Heating</li> <li>Seat support / head restraints</li> <li>Adjustable mirrors / rear view mirrors / camera</li> <li>Heating / air conditioning</li> <li>Display lighting</li> <li>Vision / wipers</li> <li>Safety – seatbelts / crumple zone / side impact / air bags</li> </ul> </li> </ul> <p>If the focus of the answer is limited to only 1 or 2 elements (car seat) this will limit marks. NB: Accept a product within a kitchen, e.g. kettle – again limits marks.</p>	<b>14</b>	<p><b>Low:</b> Confused or shows limited understanding of ergonomics and/or orthographics and their application. Only a small number of basic features included. <b>(0 – 4 marks)</b></p> <p><b>Inter:</b> Good range of specific features which are appropriate and demonstrate reasonable appreciation of ergonomics / anthropometrics and application. <b>(5 – 9 marks)</b></p> <p><b>High:</b> Shows full and accurate understanding of ergonomics and anthropometrics with comprehensive range of features explained within the chosen context. <b>(10 – 14 marks).</b></p>



Question	Part		Marking Guidance	Mark	Comments
2	03		<p>More able candidates should demonstrate good grasp of government and international legislation and regulation, weaker candidates may write in more generic terms which lack detail and fact to support their views.</p> <ul style="list-style-type: none"> <li>• Packaging – directive introduced in 1994 amended 2004 sets target for reduction of packaging waste, re-cycling and re-use. Also limits the amount of toxic metals in packaging. By 2008 60% of packaging waste to be recovered and 55% re-cycled. Manufactures could limit packaging / use of non – recycled plastic / use of bio- degradable materials. Accept carrier bags, bag for life etc.</li> <li>• Energy use – Energy labelling EU directive introduced in 1996. States that electrical appliances such as washing machines/ refrigerators will be rated from A to G according energy use. Appliances which have stand – by mode, use solar energy, sensors to switch on/off, improved insulation / non – conductive materials, smart materials. Answers may also relate to motor vehicles / domestic heating etc.</li> <li>• End of use – WEEE Directive implemented in 2006 applies to electrical and electronic products to be able to be dismantled, parts reused or re-cycled. Answers may also relate to non – electric goods, motor vehicles etc.</li> </ul>	14	<p><b>Low:</b> Non – specific or unimportant issues. Fails to show when/why/what the effect would be upon the environment and what proposals would be. <b>(0 – 2 marks)</b></p> <p><b>Inter:</b> Specific examples used which are appropriate and demonstrates reasonable appreciation of effects upon the environment. <b>(3 – 5 marks)</b></p> <p><b>High:</b> Accurate and appropriate examples which show excellent appreciation of environmental impact. <b>(6 – 7 marks)</b></p> <p><b>(2 x 7 marks)</b></p> <p>Although legislation is the focus of the question, do reward answers which go directly to the changes and impact that these have had.</p> <p>Accept regional variations on re-cycle schemes, e.g blue / green bins, etc.</p>

Question	Part		Marking Guidance	Mark	Comments
3	04		<p>Better answers may include details of what would be the cause / effects of degradation. Although some protection methods may be more straight forward, others more complex there is no opportunity to avoid the less complex.</p> <ul style="list-style-type: none"> <li><i>Garden Furniture</i> – Do not accept paint / tanalising / creosote as there would <b>not</b> be appropriate for a <b>hardwood</b> as the high cost of the raw material could only be justified aesthetically if the grain is visible <b>OR</b> wax as this would not suit outdoor environment. Accept – basic names e.g. varnish / teak oil, but give credit for additional details i.e. Clear/ transparent, polyurethane, cellulose, yacht, micro – porous, etc. Stains can be applied first in order to enhance colour. Knots treated to seal resin. Finish applied after sanding, by brush/cloth or spray and applied regularly.</li> <li><i>Climbing frame</i> – Accept paints, galvanising, plastic coating, powder coating. <ul style="list-style-type: none"> <li><i>Bicycle Wheels</i> - anodised to generate tough oxide layer, can add top coat of lacquer</li> <li><i>Drinks carton</i> – varnish or laminated with clear plastic</li> </ul> </li> </ul>	28	<p><b>Low:</b> Generic (paint) or inappropriate examples. Shows limited understanding of finish / barrier and its application / use. <b>(0 – 2 marks)</b></p> <p><b>Inter:</b> Specific examples used which are appropriate and demonstrates reasonable appreciation of methods and use. <b>(3 – 5 marks)</b></p> <p><b>High:</b> Accurate and appropriate examples which show excellent appreciation of when / why / how methods are used. <b>(6 – 7 marks)</b></p> <p><b>(4 x 7 marks)</b></p> <p>Although some protection methods may be more straight forward, others more complex there is no opportunity to avoid the less complex.</p>

Question	Part		Marking Guidance	Mark	Comments
4	05		<p>Manufacture may be in small or large volume according to selected process.</p> <ul style="list-style-type: none"> <li>• <i>Laser cutting</i> – fine detail cutting (more so than plasma), little waste, controlled by CNC – linked to CAD, use on paper, card, plywood, MDF, plastics – acrylic, can be set for engraving. Manufacturer should be aware of issues such as scorch marks on timber, carbon deposit on metals, and take account of focal length of lens, etc.</li> <li>• <i>Offset lithography</i> – versatile and economic printing process. Uses 4 colour – cyan, magenta, yellow, black and up to five – colour presses. Can include varnish for protective barrier. Single sheet or continuous web feed printing, use of registration marks for accuracy. Single or double sided printing.</li> <li>• <i>Rapid prototyping</i> – RPT – Stereo – lithography, CNC created 3D objects, laser to solidify liquid polymers, LOM – layered object modelling – card / paper to form 3D, FDM – fused deposition modelling – extruded liquid polymers.</li> <li>• <i>Die casting</i> – use of low melting point metal (zinc, magnesium based) into alloy steel die by gravity or pressure feed. Fluxes used to reduce oxidation. Fine detail and large volume available. Hot or cold chamber casting according to product complexity and size.</li> <li>• <i>Injection moulding</i> – use of thermoplastic, complex 3D forms, pigmented, use of additives / fillers, high volume consistent and accurate, set up costs, multi mould / over moulding.</li> <li>• <i>Calendering</i> – thermoplastic sheet, film and laminate coating. Shopping bags, PE / PVC.</li> </ul>	28	<p><b>Low:</b> Non – specific or inappropriate examples. Fails to show when / why method or process is used. Shows limited understanding of method / process. <b>(0 – 2 marks)</b></p> <p><b>Inter:</b> Specific examples used which are appropriate and demonstrates reasonable appreciation of methods / process and use. <b>(3 – 5 marks)</b></p> <p><b>High:</b> Accurate and appropriate examples which show excellent appreciation of when / why / how methods / processes are used. <b>(6 – 7 marks)</b></p> <p><b>(4 x 7 marks)</b></p> <p>Do not over-reward a description of the process.</p>



Question	Part		Marking Guidance	Mark	Comments
5	06		<p>It is expected that candidates begin with an annotated description of their chosen product e.g. iPod, Dyson, Mini, etc no specific marks to be given for the quality of the description but reserve them for how the answer references the explanation to the criteria:</p> <ul style="list-style-type: none"> <li>• <i>Originality</i> – new product or aspects which are innovative, e.g. iPod menu navigation, Mini transverse engine, Dyson cyclone, etc. Use of materials, technology, manufacture to produce quality in product.</li> <li>• <i>Function</i> – how design and manufacture relate to function, satisfies need.</li> <li>• <i>Aesthetics</i> – effect of form, style, fashion/era, use of colour / materials / texture etc.</li> </ul>	14	<p><b>Low:</b> Candidate shows only basic understanding of the three aspects <i>originality</i>, <i>excellence</i>, <i>utility</i>, or may concentrate upon one/two, and how they are exhibited within the chosen product. The chosen product will have given limited opportunity to show these and issues will be quite basic. <b>(0 – 4 marks)</b></p> <p><b>Inter:</b> Candidate has a reasonable understanding and knowledge of the terms and their application. Aspects of <i>originality</i>, <i>excellence</i> and <i>utility</i> are shown to feature effectively within their chosen product, although there will be some less well covered than others. <b>(5 – 9 marks)</b></p> <p><b>High:</b> Candidate fully appreciates how each aspect contributes to the overall success of the chosen product. Each one is covered in detail and shown with reference to an appropriate product. <b>(10 – 14 marks)</b></p>
5	07		<p>Linked to inclusive design but the quality of the answer will be largely dependent upon the selection of an appropriate product.</p> <p>Changes suggested to domestic products such as kettles, taps, stair lifts, shower seats / bath lifts, wheel chairs, mobility vehicle adaptations, ergonomic telephones / keyboards.</p> <p>Accept also environments such as a shower room.</p>	14	<p><b>Low:</b> Simple statements, generic non – specific to needs of user / product, some inaccuracies. Few number of issues described, shows a lack of knowledge of the problems and how they may be eliminated. <b>(0 – 4 marks)</b></p> <p><b>Inter:</b> Shows understanding but lacks detail. Generalised statements with minor inaccuracies. <b>(5 – 9 marks)</b></p> <p><b>High:</b> Wide and varied range of issues described with both detail and reference to the specific application, appropriate to both the needs of the user and modification to the product. <b>(10 – 14 marks)</b></p>



Question	Part		Marking Guidance	Mark	Comments
6	08		<p>The question may be considered to be quite broad and approached from a number of directions, obviously linked to a specific industry product, as required in the question. A specific industry is required to set the context but it is not rewarded specifically.</p> <ul style="list-style-type: none"> <li>• QRM – Quick response manufacture – made to order</li> <li>• EPOS – Electronic point of sale</li> <li>• JIT – Just in time</li> <li>• Kanbans – stock control by computer</li> <li>• MPS – master production schedule – materials / component planning for each specific product by computer</li> <li>• Telematics – electronic tracking of product to order</li> <li>• FMS – flexible manufacturing system to allow production to vary according to demand.</li> </ul> <p>Also may consider QC quality assurance and QC quality control as necessary to deliver high standard of goods. Scales of production and planning through flow chart etc. Basic features of CAD / CAM / CNC / robotics control of laser cutting may be rewarded.</p>	18	<p><b>Low:</b> Candidate shows only basic knowledge of the types of processes available and offers only a tenuous link to a suitable product. <b>(0 – 6 marks)</b></p> <p><b>Inter:</b> Candidate has a reasonable understanding and knowledge of the processes and their application to a stated product. There is some variety and range in the answer together with some use of appropriate terminology. <b>(7 – 12 marks)</b></p> <p><b>High:</b> Candidate fully appreciates the wide range of processes available and these are specifically linked to an appropriate application/ product. Explanations are in detail and accurate with correct terminology. <b>(13 – 18 marks)</b></p>

Question	Part		Marking Guidance	Mark	Comments
<b>6</b>	<b>09</b>		<p>Candidates will be expected to reply with specific detail of their own planning for both design and manufacture. This may include analysis of need / brief, client needs, research techniques to generate a specification. Modelling, testing in development and planning (use of flowcharts, etc) for manufacture with consideration of quality control, selection of materials and processes to give quality assurance, etc.</p> <p>Although not asked to describe the product or project, a lack of any description or title may limit marks awarded.</p>	<b>10</b>	<p><b>Low:</b> Simple statements, generic non-specific to a named product. Concentrate upon one aspect at the cost of others. Few number of issues described, shows a lack of knowledge of the problems and how they may be eliminated. <b>(0 – 3 marks)</b></p> <p><b>Inter:</b> Shows understanding but lacks detail, generalised statements with minor issues and limited scope. <b>(4 – 7 marks)</b></p> <p><b>High:</b> Wide and varied range of ideas described with both detail and reference to the specific application, appropriate to product and covers both design and manufacture in detail. <b>(8 – 10 marks)</b></p>



