A-LEVEL
DESIGN AND TECHNOLOGY: PRODUCT DESIGN 3D

PROD1

Mark scheme

1550/2550

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Question 1

1			E.g. Packaging products such as cereal boxes, fruit juice cartons, shoe boxes. Accept references to products made from corrugated carton board. Reasons such as: Easy to cut and score to nets for boxes. Can be easily printed on for bar codes, product information. Available in large sheet sizes for die cutting many at once. Flat surface suitable for printing graphics. Can be laminated with a polymer/foil to provide a waterproof container. Etc.	3	1 mark for the product. 1 mark per reason. If no product named award zero marks. If product is incorrect award credit as appropriate for applicable points.

Question 2

2			MIG welding **B** (Addition) Drilling a hole **A** (Wasting) Sand casting **C** (Redistribution)	3	

Question 3

3	(a)		E.g. Soft drinks bottles, water bottles, plastic bottle, oven safe/microwave food packaging, clear cosmetics/shampoo packaging, vegetable/soft fruit trays.	1	

3	(b)		Recycling symbol, SPI code, to indicate the product is recyclable. Recycling is good for the environment as plastic comes from crude oil, a finite resource. Product is a single use product so recycling saves resources. Some companies have to meet Eco targets and being able to recycle the product will help meet these. Etc.	2	1 mark for stating the meaning. 1 mark for the explanation. If part (a) is incorrect or no product named, award credit as appropriate for references to recycling in part (b).

Question 4

4	(a)		A mixture of two or more different materials to produce a material with enhanced properties. Accept the word 'combination'.	2	1 mark for simply stating two or more materials. Must refer to enhanced properties for two marks.

4	(b)		E.g. GRP, CFRP, Plywood, MDF. Accept references to cermets such as tungsten carbide. Do not accept 'carbon fibre', 'fibreglass'. Applications such as: Boat hulls, bicycle frames, items of sports equipment such as tennis racquets, furniture etc.	2	1 mark for naming a composite. 1 mark for the application. If no composite is named award zero marks.

Question 5

5	(a)		Hardwoods	1	

5	(b)		Two marks for any suitable application for the named timber. Must refer to either oak or ash.	2	2 marks for application. If no timber or a timber other than oak or ash is named award zero marks.

5	(c)		Reasons should be explained referring to stated product. e.g. Oak for a coffee table. Aesthetically pleasing due to grain pattern and mid brown colour. Easy to cut with standard tooling such as band saws to enable legs and parts to be cut to shape. Tough material will be able to withstand items such as TV remote controls being dropped onto it. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained. If no timber or product named in part (b) award zero marks. If named timber is one other than oak or ash in 5(b) award credit for relevant points. Do not double penalise.

Question 6

6	(a)	(i)	E.g. Easy to cut and score to make aspects such as steps, walls and roofs. Available in standard thicknesses e.g. 3mm and 5mm to give realistic model scale. Available in large sheet sizes for making large scale models. Lightweight, easy for the architect to transport to a client. Can be glued with a variety of adhesives. Flat surface that can have a variety of finishes applied for decorative effects. Can be painted with acrylic/enamel paints to add features such as concrete effect. Etc.	8	1-2 marks per relevant point. Award second mark where point is explained. **Max 4 for a list of unexplained properties.** 'Easy to cut with a craft knife' = 1 mark 'Easy to cut with a craft knife to make features such as windows' = 2 marks

6	(a)	(ii)	E.g. Malleable which allows the can shape to be cupped and deep drawn. Non-toxic material will not contaminate the contents. Low melting point, making it easy to recycle. Available in thin sheet form for punching the blank shape. Chemical resistant so will not contaminate the contents/ poison the user. Widely available which is required for mass production. Etc.	8	1-2 marks per relevant point. Award second mark where point is explained. **Max 4 for a list of unexplained properties.**

6	(b)	(i)	Accept any appropriate product. Expect responses such as car bodies, aircraft bodies, bicycle frames, model cars, cooking pans, cooking foil, take-away containers, candle holders, lamp shades etc.	1	

6	(b)	(ii)	Accept any appropriate manufacture method for the stated product. Accept 'die casting' on its own. Do not penalise for not stating the specific die casting method e.g. high pressure/gravity etc. Do not accept 'welding'. Must be specific e.g. TIG/MIG.	1	If no product is stated in 6(b) award zero marks.

6	(b)	(iii)	Accept any appropriate reason(s). Expect responses such as: Low melting point makes it suitable for die casting into the intricate shape. Spinning allows the pan to be formed from one single piece of material. Etc.	2	1-2 marks per relevant point. Award second mark where point is explained. If no product is stated in 6(b) award zero marks. If no process or incorrect process in 6(b)(ii) award zero

Question 7

7	(a)	(i)	Accept plywood, flexi ply, aero ply, flexi MDF, trade names such as Bendywood, oak/ash/birch or similar hardwood veneers, laminated hardwood veneers.	1	Do not accept any softwood veneer. Hardwood = 0 marks Named hardwood e.g. oak= 0 marks Named hardwood veneer e.g. oak veneers = 1 mark

7	(a)	(ii)	E.g. Plywood is available in long wide sheets unlike solid timber; this removes the need to join pieces together. Plywood can be steamed to make it pliable enough to laminate into the curved shape. Plywood can have veneers applied to the surface to make it look like a more expensive timber. Plywood is stable and has no grain issues like a solid timber so once laminated will not warp or change shape. Plywood is cheap = 0 marks Plywood is cheaper than solid timber = 1 mark Plywood is cheaper than a suitable named hardwood of a similar size = 2 marks.	4	1-2 marks per relevant point. Award second mark where point is explained. **Max 2 for list of unexplained properties.** If material named in (a) (i) is incorrect, credit any relevant properties. Do not double penalise.

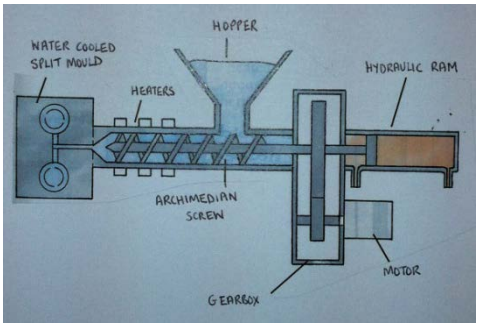
7	(a)	(iii)	E.g. Laminating/ steam bending part A of the seat: Manufacture of suitable former(s) Steam to soften fibres Application of Cascamite or similar adhesive Clamping of veneers/ Bagpress method Drying time, trimming/sanding edges Cutting the legs to length with a metal cutting bandsaw/hacksaw. Bending the legs with a pipe bender/jig Drilling holes for screws/ use of K-D fittings for attachment.	10	Simple description with little detail. Diagrams are basic. (0-3) Better description using correct tooling. Diagrams mostly complete and appropriate. (4-7) Fully detailed descriptor with accompanying diagrams displaying correct terminology and tooling. For full marks the former(s) must reflect the seat shape. (8-10) **If no diagram max 5 marks** **If no description max 5 marks** **Max. 5marks if only one part of the chair is described.**

7	(b)		Expect references to specific finishes such as Polyurethane varnish/lacquer, Danish Oil. Do not accept references to Beeswax, paint. Accept references to method for finishing the seat and/or the advantages of the finish. E.g. Sanding the timber material with varying grades of sand paper. Removal of dust from surface. Application of finish with brush, in direction of grain. Sanding high spots, second coat. E.g. Polyurethane varnish is available in clear to enable the grain to still be visible. Polyurethane varnish can provide water resistance to prevent damage from spilled drinks.	5	Award **one** mark for a specific named finish. Simple notes/ diagrams, limited detail (1-2 marks) Clear, detailed description of the process (3-4 marks) 1-2 marks per relevant point. Award second mark where point is explained.

Question 8

8	(a)	(i)	Suitable thermoplastic polymers such as: ABS, HDPE, PP, etc Accept references to TPE for the grip section.	1	Do not accept any named thermoset, acrylic, PET or LDPE

8	(a)	(ii)	E.g. Impact resistant therefore will not break when dropped on the floor. Is a thermoplastic so can be recycled at the end of its lifetime and will not contribute to land fill. Can be pigmented during manufacture to give the black colour for the casing. Is a thermoplastic so can be injection moulded to produce the complex holes for the speaker.	6	1-2 marks per relevant point. Award second mark where point is explained. **Max 3 for list of unexplained properties.** If no material in 8(a)(i) award zero. If material in 8(a)(i) is incorrect credit any relevant properties.

8	(a)	(iii)	Injection moulding  Polymer granules loaded into hopper Archimedean screw moves the granules past the heaters where they soften Softened polymer builds up at the injection point, Archimedean screw moves back. When sufficient polymer has gathered the hydraulic ram moves the Archimedean screw forwards which injects the polymer into the split mould. The mould is water cooled. The mould opens and ejector pins push the product out. Any flash would be removed.	8	Mark breakdown: Simple description with little detail. Diagrams are basic with incorrect labels. (0-3) Better description using correct terminology. Diagram mostly complete and correct. (4-6) Fully detailed descriptor with accompanying diagrams displaying correct terminology For full marks the mould must reflect the product shape. (7-8) **If no diagram max 4 marks** **If no description max 4 marks**

8	(a)	(iv)	Expect reference to the 3Rs Reducing the amount of polymer used for the casing. Re-using the circuit board/components. Manufacturing from recyclable polymer to save resources. Also accept reference to points such as the use of bio-batch or previously recycled polymers, SMAs in the circuit board to allow ease of recycling, recycling logos on the external packaging, reduced packaging etc.	4	1-2 marks per relevant point. Award second mark where point is explained.

8	(b)		Possible answers might include: Phosphorescent pigment to let it glow in the dark. Thermochromatic pigment in the side grips so it changes colour when the child holds it. Polymorph for shaping the sides for comfort. SMAs to allow the antenna to crumple up then return to its normal shape. Accept references to the use of polymorph to shape the casing for finger grooves. Etc.	6	1-2 marks per relevant point. Award second mark where point is explained via text or diagram.

8	(c)		Possible answers may include: **Attracting the target market:** Use of colours, appropriate text, graphics, cartoon characters, pictures of product in use/ children having fun, cut away part for child to touch the product/press a button etc. **Suitable retail packaging:** Product securely held in place, euro slot, recycling symbol, bar code, CE mark, appropriate materials such as card based materials/ thermoplastics/ starch based or bio batch polymers/ recycled materials, reduced quantity of material in packaging. Details of manufacture such as use of card nets, press knife, off-set lithography or digital printing, eco inks, vacuum forming package, crimping edges/staples etc. Give credit for features that add value to the package e.g. re-use of the package to store the toys in a 'spy pack', store other items. **N.B Candidates cannot re-design a whole new package, it must resemble the original basic form.**	15	Mark breakdown: Basic diagrams and simple notes about the product. Materials/ manufacture process uses non-specific terminology e.g. plastic, card, cut and fold into shape. **(0-5 marks)** Better diagrams with suitable specific materials and manufacture methods named e.g. use of 'nets', 'scoring' card etc. Some good styling of the package. **(6-10 marks)** Full development taking into account all points. Specific suitable materials and manufacture methods. Clear diagrams to show an appropriate design. Some innovative features proposed. **(11-15 marks)** **If answer only addresses one aspect, max 8 marks.** If product is a re-design **max 5** marks.