GCE

Design and Technology: Product Design 3D

PROD1 – Unit 1

Mark scheme

1551 / 2551

June 2016

Version: 1.0 Final

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.

Further copies of this mark scheme are available from aqa.org.uk

Question	Part	Sub Part	Marking guidance	Mark	Comments
1			PET fizzy drink bottle **B** (Blow moulding) Vinyl letting for a sign **A** (CNC Plotter cutter) PLA prototype of a design **E** (3D printing) PP Yoghurt pot **C** (Vacuum forming)	4	4 x 1 mark. Each letter can only be used once. No mark awarded to a repeated letter.
2	(a)		A mixture of two or more metals to produce a material with enhanced properties.	2	A mix of metals = 1 A mix of two or more metals = 1 Metal joined to produce an enhanced metal = 0
2	(b)	(i)	Accept any Ferrous or Non-Ferrous alloy e.g. Brass, Bronze, Duralumin, Stainless Steel, High Speed Steel, Die/Tool Steel, High tensile steel, Nitinol. Any appropriate application such as: Brass – door furniture, taps, boat fittings etc. Bronze – Statues, coins, bearings etc. Duralumin – Aircraft structural components, bicycle components, mobile phone bumper etc. Stainless Steel – kitchenware, sinks, cutlery, worktops etc. High Speed Steel – Cutting tools, drill bits etc. High tensile steel – Car engine components, industrial fencing wire, bicycle frames etc. Nitinol – Smart springs in fire sprinklers, dental braces, muscle wires, bone fixings etc. Accept 'aluminium' as an alloy.	2	1 mark for the alloy. 1 mark for the application. If no alloy named award zero marks.
2	(b)	(ii)	Reasons should be explained referring to stated application. Expect reasons such as: Brass does not rust so the water from the tap will not be tainted. Stainless steel is chemical resistant so cutlery will be able to be washed. High Speed Steel is a hard material which is needed for the drill bit to cut through other materials. Etc.	2	1-2 marks per relevant point. Award second mark where point is explained. If material in 2(a)(i) is not an alloy, award zero.

3			Wear eye protection/ wear goggles Wear hearing protection/ wear ear defenders Corrosive Danger to the environment	4	1 mark per correct meaning. No mark awarded to a repeated meaning.

4	(a)		Thermoplastics Accept thermo-softening polymer	1	Award 1 or zero.

4	(b)		E.g. **LDPE** – carrier bags, stretch food wrap, ice cube bags, household refuse sacks, lining for juice cartons, squeezy detergent bottles, electric cable outer sheath etc. **ABS** – remote control/calculator/ games controller casings, Lego bricks, computer keyboards/monitors, landline telephone casings, construction site safety hard hat etc.	1	If no material named award zero marks. 1 mark for the application.

4	(c)		Expect reasons such as: LDPE can be pigmented a colour to show shop brand e.g. orange for Sainsbury's. LDPE has good tensile strength so can hold a lot of weight in the carrier bag without breaking. LDPE can be printed on for shop brand names, advertising. Etc. ABS is impact resistant so if the calculator is dropped on the floor it will not shatter. ABS can be pigmented to show different function buttons such as red for on/off. ABS is scratch resistant so the calculator will not be damaged by other items in a school bag or pencil case. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained. If no material or application given in part (b) award zero marks.

5	(a)	(i)	Accept any appropriate man-made board such as: plywood, marine ply, chipboard, MDF etc. Do not accept hardboard, blockboard. Flexi ply	1	Award 1 or zero.

5	(a)	(ii)	e.g. Aesthetically pleasing due to the light brown colour and visible (plywood) layers. Available in large sheet sizes unlike solid timber which means the table top can be made of one piece. Less expensive than a hardwood such as oak, making it affordable to the customer. Can have finishes such as Danish oil/ polyurethane varnish applied to make it water and heat resistant. Has no grain so will not splinter or split when being cut to shape / drilled into for the screw joint. Can be easily cut with standard tools such as a jigsaw or bandsaw to cut the leg shape. Can be veneered to imitate a more expensive material such as solid ash. Tough material so is unlikely to dent if a remote control was dropped on it. Etc. Plywood is cheap =0 Plywood is cheaper than solid timber = 1 Plywood is cheaper than oak (any suitable named hardwood) of a similar size = 2	6	1-2 marks per relevant point. Award second mark where point is explained. **Max 3 for a list of unexplained properties.** If material named in (a)(i) is incorrect, credit any relevant properties. Do not double penalise.

5	(a)	(iii)	Expect references to: Cutting the table sections to length. Drilling holes for screws/dowel joints. Clamping/screwing together with PVA glue. Cutting legs to shape and sanding. Drilling holes for attachment to table section via screws/dowels etc. CNC parts cutting must include specific named machinery and references to setting up method (feed rate/material input/speed rate/clamping material etc.) Accept references to any appropriate joining method e.g. screw and glue joints and end cap/plug, dowel or through dowel joints, cam fitting etc. Credit should be awarded to any finishing processes such as sanding edges and surfaces, application of specific finish.	9	Mark breakdown: Simple description with little detail. Diagrams are basic. (0-3) Better description and diagrams using correct terminology. (4-6) Fully detailed descriptor with accompanying diagrams, correct tooling etc. (7-9) **If no diagrams max 4 marks** **If no description max 4 marks**

5	(b)		Accept advantages to manufacturer and/or consumer. E.g. Flat pack takes up less room than ready assembled so the customer can transport the product home in their car. Can be assembled with basic tools which are often supplied so the customer needs few skills. Customer can attain a sense of achievement from building their own furniture. Can be disassembled easily so can easily be packed when moving home. Flat pack so is easy to move upstairs or to the location for the product. Flat pack does not normally contain complicated joints so the manufacturer does not have to employ highly skilled labour. Flat pack boxes takes up less room in a delivery truck than ready assembled so the manufacturer can transport more in one trip. Flat pack often uses K-D fittings which can be bought as standard and packed, thus reducing lead time. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained. **Max 2 for an unexplained list.**

6	(a)	(i)	e.g. Is a thermoplastic and can be easily blow moulded which is the process used to make the bottle shape. Chemical resistance will not degrade due to the shampoo contents. Chemical resistant will not contaminate/react with the shampoo it is holding. Can be pigmented to show brand colours. Available in transparent so the user can see how much shampoo is left in the bottle. Is a thermoplastic, can easily be recycled which is important for a short life product. Flexible to allow shampoo to be squeezed out. Impact resistant will not smash if dropped in the shower. Etc. Can be printed on for brand names and ingredient lists = 1 specific printing process should be named.	8	1-2 marks per relevant point. Award second mark where point is explained. **Max 4 for a list of unexplained properties.**

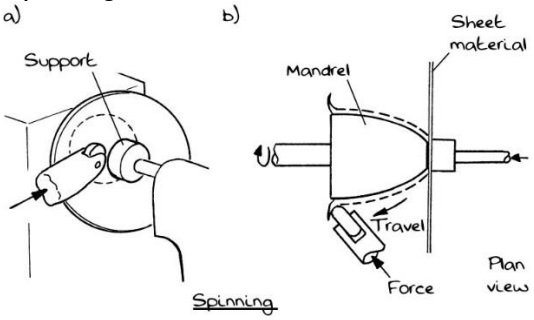
6	(a)	(ii)	e.g. Corrugated card is compliant and easy to cut and fold to a box shape using a die cutter. Is a food safe material, the pizza will not be contaminated by the card. Is an insulating material which will help keep the pizza warm. Corrugated card is a lightweight material which makes it easy to carry on a delivery bike. Pizza box is a single use product, corrugated card is easily recycled so box should not contribute to landfill. Will biodegrade so won't contribute to landfill. Can be incinerated easily. Etc. Can be printed on to indicate food labelling and/or advertising logos = 1 (specific printing process should be named).	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)	Forest Stewardship Council	1	Award 1 or zero.

6	(b)	(ii)	Expect responses such as: It is used to show that a timber product has come from a sustainable source. It is used because FSC symbol is a global forest certification so the customer knows the wood is from a sustainable source. It is used to show that FSC ensures forests are properly managed e.g. trees are replanted when cut down. It is used by manufacturers who may use FSC certified products to attract eco-friendly consumers. It is used to show that FSC manages the forest to conserve the local eco systems and help prevent land erosion and damage. It is used to show that FSC manages the forest animals and plants by not allowing trees to be cut from protected areas. It is used to show that FSC uses local workers to run the forest and ensures a cycle of employment, training and good work conditions so locals can be involved in keeping the standard and not partake in illegal logging. It is used to show that FSC ensure any sacred sites of indigenous people are kept and not destroyed by logging and forest clearance. By using FSC timber the manufacturer can show they are complying with EU timber regulations (EUTR). Etc.	3	1-2 marks per relevant point. Award second mark where point is explained.

7	(a)	(i)	Accept Stainless Steel, aluminium or chrome plated mild steel. Do not accept 'mild steel' or 'steel'.	1	Award 1 or zero.

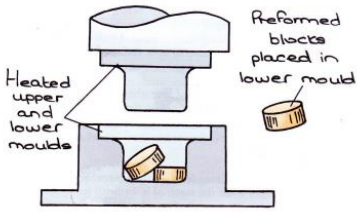
7	(a)	(ii)	E.g. Malleable so will be easy to form into the curved shape. Malleable so is easy to use for spinning which is the process used to produce the body. Is a non-ferrous metal and will not rust so the water is safe to drink. Stainless Steel does not rust with the water so will keep its aesthetics. Aesthetically pleasing due to its shiny colour. Stainless steel's shiny neutral colour fits with modern kitchen décor. Stainless Steel is food safe and will not react with the water contents. Stainless Steel is chemical resistant so the kettle can be cleaned with detergents. Etc.	6	1-2 marks per relevant point. Award second mark where point is explained. **Max 3 for list of unexplained properties.** If material named in (a)(i) is incorrect, credit any relevant properties. Do not double penalise.

7	(a)	(iii)	Spinning  Description: Stage 1- a flat metal sheet is secured in place in a machine similar to a lathe. Stage 2- the material is held in place between the tailstock and the mandrel/former. Stage 3- the mandrel/former may be in the shape of the kettle body. Stage 4- the metal and mandrel start spinning at high speed Stage 5- the roller is pushed onto the sheet gradually forces the metal onto the mandrel/former. Stage 6- the roller assist the flow of the material over the mandrel/former to make the shape. Stage 7- the clamp is released and the product removed.	7	Simple description with little detail. Diagrams are basic with incorrect labels or incomplete parts. (0 – 2marks) Better description using correct terminology. Diagram mostly complete and correct (3 – 4 marks) Full description. Correct/complete diagram. Detail includes terminology (5 – 7 marks) Mould does not need to resemble product. **If no diagrams max 4 marks**

7	(b)		Possible answers might include references such as: **Handle:** Is smooth to touch so kettle will be comfortable to lift. Has no grips so may be slippery when wet from the water. Finger grooves should be added for grip. The handle should have texture for grip / TPE over-mould for grip. Plastic looks very rigid so may not be comfortable to hold. **Handle length:** Handle is long enough for a large hand to hold comfortably. Handle is not long enough for a large hand to hold comfortably. Handle is too long for a small female hand which could lead to imbalance when pouring or filling the kettle. **Handle width:** Handle is too wide/thick for a small hand to hold easily. The photo shows there is plenty of room for the male hand to hold the handle easily as there is enough room to wrap all the fingers around it. **Switch:** Is easy / not easy to reach with the thumb when holding the handle. Switch has a clear 1 and 0 printed beside it which are internationally recognised symbols for on and off. Switch is very smooth and should have grooves for grip. **Base:** The base is a universal base which means the kettle can spin round, making the kettle easy to use for both left and right handed users. Easy to connect without the need to push a mains lead into the kettle body. **Water level:** The markings are on both sides making the scale easy to read for both left and right handed users. The markings are white which may/may not stand out very well and be easy/ difficult to	12	1-2 marks per relevant point. **If no diagrams, max 6.**

			read. The markings are in litres so the user can tell how much water to put in, there are no language barriers. **Safety issues:** The handle and lid handle and made from plastic which is an insulator; this means the user will not get burnt when lifting/filling the kettle. The flex is insulated. The plug is fused. The lid grip is narrow and the user may burn on the metal when re-filling the kettle. The body of the kettle is made from metal which is a conductor of heat. The user may burn if they touch the sides. Kettle is electrically isolated when lifted off base either when filling or pouring. The kettle has a wide stable base this means it will be steady in use. The kettle has an indicator light so the user can easily see if it is switched on and getting hot. Etc.		

7	(c)	(i)	E.g. UF is scratch resistant and will not be damaged by the pins of the plug on the surface. UF is an electrical insulator so will be safe for use with electrical appliances. UF can be pigmented to provide the white colour for home colour schemes. UF is a thermosetting polymer and will not heat up and melt if there is a short circuit or electrical fire. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained.

7	(c)	(ii)	Compression moulding  Description: Stage 1- a pre-weighed 'slug' of material is placed between the two mould halves. Stage 2- the mould is heated to allow the cross –links to form within the material. Stage 3- the upper mould closes into the lower mould. Stage 4- the pressure forces any excess material out. Stage 5- the moulds are held closed whilst the polymer 'cures'. Stage 6- the mould is opened and the product ejected whilst still warm.	7	Simple description with little detail. Diagrams are basic with incorrect labels or incomplete parts. (0 – 2marks) Better description using correct terminology. Diagram mostly complete and correct. (3 – 4 marks) Full description. Correct/complete diagram. Detail includes terminology. (5 – 7 marks) Mould does not need to resemble product.

7	(c)	(iii)	Possible answers might include: Cannot recycle due to cross links. Difficult to recycle. At end of life product may end up on landfill. Possible pollution when polymer degrades, harmful to wildlife/marine life. If incinerated could cause fumes/pollution. Use of thermosetting polymers does not encourage recycling. Use of thermosetting polymers still requires crude oil, a non-renewable resource. Use of thermosetting polymers may mean manufacturers do not meet environmental legislation. Thermosetting polymers can often be used for long life products, as such may not be a constant use of resources. Incineration of thermosetting polymers can be used for waste to energy plants. Etc.	3	1-2 marks per relevant point. Award second mark where point is explained.