AQA

AS
DESIGN AND TECHNOLOGY: PRODUCT DESIGN (3D)
PROD1

UNIT 1 MATERIALS, COMPONENT AND APPLICATIONS

Mark scheme

June 2017

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

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative Content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Part/ Sub part	Marking guidance	Mark	Comments
1	(a)	Timber from a deciduous tree. Trees that lose their leaves Do not credit reference to the material property 'hardness'.	1	
1	(b) (i)	Accept any specific named hardwood eg ash, oak, walnut, elm, balsa, teak, yew, mahogany, cherry. Appropriate application related to specified hardwood.	2	1 mark for the hardwood. 1 mark for the application. If no hardwood named award zero.
1	(b) (ii)	Reasons should be explained referring to stated application. Expect reasons such as: Aesthetically pleasing due to the grain pattern (accept reference to colour if linked to wood grain). Can have a finish such as Danish oil/ polyurethane varnish applied to make the product water and/or heat resistant. Easy to cut with standard tooling such as band saws to enable table tops to be cut to shape. Tough material will be able to withstand items such as TV remote controls being dropped onto it.	2	1-2 marks per relevant point. Award second mark where point is explained. If no/wrong product named award zero.
1	(c)	**Rough sawn**. Expect references such as: Timber straight from the saw/conversion process with no edges planed/dressed. **P.S.E.** Expect references such as: Planed Square Edge. Timber with all sides planed and square edges	2	(2 x 1 mark) 1 mark for each given meaning.

Question	Part/ Sub part	Marking Guidance	Mark	Comments
2		COSHH: Control of Substances Hazardous to Health PPE: Personal Protective Equipment	2	(2 x 1 mark) 1 mark for each given meaning.

Question	Part/ Sub part	Marking Guidance	Mark	Comments
3		Accept any appropriate K-D fitting such as: Cam fitting Barrel nut and bolt T-nut and bolt Screw connector Screw socket Chipboard fastener Corner plate Block connector Modesty block Worktop connector Hinge Clip cabinet connector Push fit/plug fit connector Dowels (do not accept dowel joint) etc.	3	(3 x 1 mark) 1 mark for each correctly named fitting.

Question	Part/ Sub part	Marking Guidance	Mark	Comments
4	(a)	Alloy Accept non-ferrous.	1	Award 1 or zero.

4	(b) (i)	Expect applications such as: Coins, statues, bearings, medals, jewellery etc. Accept references to architectural bronze such as: Mail boxes, door and window frames.	1	Award 1 or zero.

4	(b) (ii)	Expect reasons such as: Bronze has a relatively low melting point which makes it easy to pour into a mould. Bronze is weather resistant so will not be damaged by rain. Bronze is impact resistant so will not break if dropped (coins). Etc.	2	1-2 marks per relevant point. Award second mark where point is explained. If no/wrong application given in part (b)(i) award zero marks.

Question	Part/ Sub part	Marking Guidance	Mark	Comments
5		Garden paving slab = **E** Concrete Swimming pool slide = **A** Glass-fibre Reinforced Plastic (GRP) Body armour = **D** Kevlar Drill bit = **B** Tungsten carbide	4	A letter can only be used once. No mark awarded to a repeated letter.

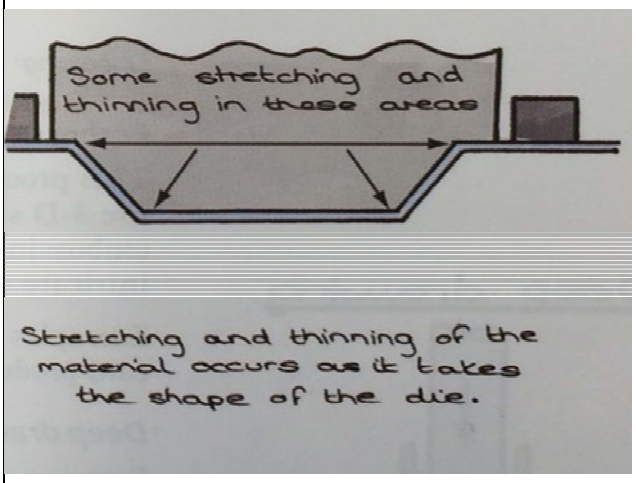
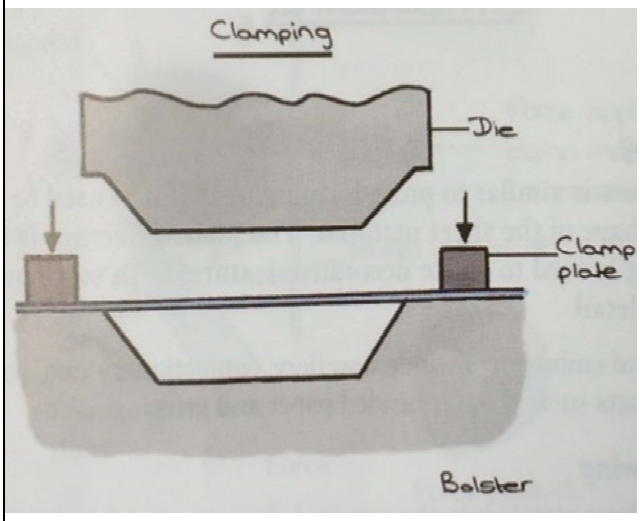
Question	Part/ Sub part	Marking Guidance	Mark	Comments
6	(a) (i)	eg Is a thermoplastic and can be easily vacuum formed/injection moulded to the margarine tub shape. Chemical resistant will not contaminate/react with the margarine it is holding. Non-toxic, will not harm the contents or the user/food safe. Can be pigmented to show brand colours. Is a thermoplastic, can easily be recycled which is important for a short life product. Impact resistant, will not smash if the tub is accidentally dropped. Scratch resistant, will not scratch if a knife is used to scrape the margarine from the tub. Can be printed on via offset lithography/flexography for brand names and ingredient lists. Etc. NB: Do not accept lightweight	8	1-2 marks per relevant point. Award second mark where point is explained. Max 4 for a list of unexplained properties.

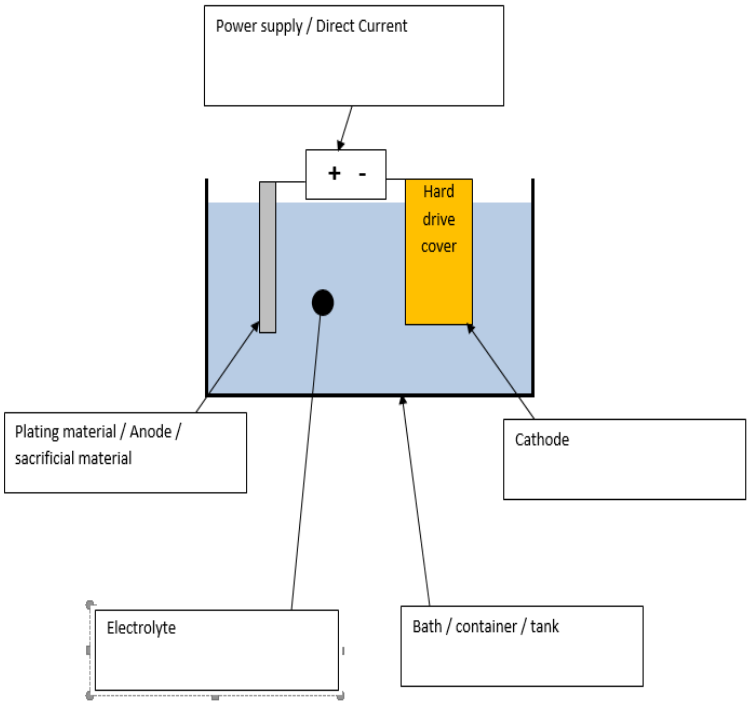
6	(a) (ii)	e.g. Available in sheet form/malleable for press forming the sink shape. Suitable for piercing and blanking to punch out holes for plugs, taps and overflows. Chemical resistant will not degrade when using detergent to clean it/dishes. Is a shiny silvery colour which fits in with kitchen styles. Is a shiny silvery colour which makes it look clean and hygienic. Is a ferrous alloy, will not rust when water is put into the sink. Impact resistant, will not smash if pans are dropped into the sink. Scratch resistant, will not scratch if cutlery is in the sink when washing up. Scratch resistant, will not wear away if cleaned with a scouring cloth. Etc. Do not accept tough	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)	eg Biodegradable plastics are plastics that degrade/break down/rot in the soil = 1mark Biodegradable plastics are plastics that degrade/break down in the soil by the action of living organisms usually bacteria/sunlight/water/oxygen = 2 marks Accept references to the use of bio-batch additive being used.	2	1-2 marks per relevant point. Award second mark where point is explained.

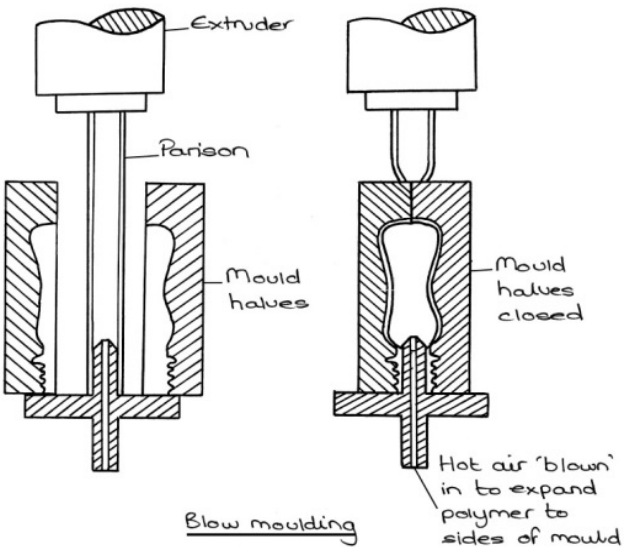
6	(b) (ii)	eg Biodegradable so will not add to landfill, important for a short life product. Good tensile strength to hold the weight of the shopping. Available in thin sheet form for calendaring the bag shape. Can be pigmented to show brand colours. Able to take the shape of the shopping within it. Etc.	2	If no reference to biodegradable max 1 mark Award second mark where point is explained. No marks for repetition of statements from (b)(i)

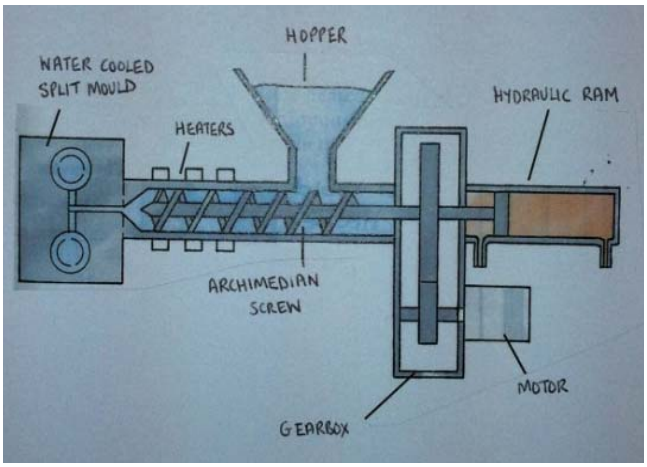
Question	Part/ Sub part	Marking Guidance	Mark	Comments
7	(a) (i)	eg Can be anodised to produce a hardwearing finish. Can be anodised/powder coated to produce an aesthetically pleasing range of colours. Is non-ferrous so will be not be affected by the sweat/moisture from fingers when touching it. Available in sheet form for press forming the shape. Malleable, easy to press form the shape. Impact resistant, will not smash if dropped from a desk. Scratch resistant, will not scratch if placed in a school bag and moves around. Low melting point, making it easy to recycle. Etc. NB: Some candidates may make reference to die casting or milling. NB: Do not accept lightweight	6	1-2 marks per relevant point. Award second mark where point is explained. Max 3 for a list of unexplained properties.

7	(a) (ii)	Press forming   Description: Stage 1- The cold flat metal sheet is placed between the die and bolster. Stage 2- The sheet is clamped onto the bolster. Stage 3- The die moves down and presses the sheet metal into the shape of the die/product. Stage 4- Stretching and thinning of the material takes place as it takes the shape of the die. Stage 5- The metal shape is removed and trimmed if required. Accept reference to lower/upper mould, male/female mould halves etc.	9	Mark breakdown: Nothing worthy of credit **(0 marks)** Simple description with little detail. Diagrams are basic. **(1-3 marks)** Better description and diagrams using correct terminology. **(4-6 marks)** Fully detailed descriptor with accompanying diagrams, correct terminology etc. **(7-9 marks)** Die must be in the shape of the product for 9 marks. If no diagrams, max 4 marks. If no description, max 4 marks.

7	(b)	Anodising process diagram  	5	1 mark per correct label. **Award marks for anode or cathode either way round.**

Question	Part/ Sub part	Marking Guidance	Mark	Comments
8	(a)(i)	eg Is a thermoplastic and can be easily blow moulded which is the process used to make the bottle shape. Chemical resistant will not contaminate/react with the water it is holding. Chemical resistance will not degrade if juice is placed inside. Can be pigmented to show brand colours. Available in transparent so the user can see how much water is left in the bottle. Is a thermoplastic, can easily be recycled so will not contribute to landfill. Flexible to allow water to be squeezed out. Impact resistant will not smash if dropped on the ground. Etc. NB: Do not accept lightweight or tough	6	1-2 marks per relevant point. Award second mark where point is explained. Max 3 for a list of unexplained properties.

8	(a)(ii)	Blow moulding  Stage 1- The parison/preform is heated and softened and extruded vertically downwards into the split mould. Stage 2- Mould halves close trapping the neck of the parison/preform. Stage 3- Air is blown into the parison/preform. Stage 4- The hot air forces the parison/preform outwards to the sides of the mould. Stage 5- The polymer cools in the mould. The mould halves open and the product is released. NB: Do not credit any references or diagrams related to injection moulding.	9	Mark breakdown: Nothing worthy of credit **(0 marks)** Simple description with little detail. Diagrams are basic. **(1-3 marks)** Better description and diagrams using correct terminology. **(4-6 marks)** Fully detailed descriptor with accompanying diagrams, correct terminology etc. **(7-9 marks)** Flash removed and mould must be in the shape of the product for 9 marks. If no diagrams, max 4 marks If no description, max 4 marks Accept blow moulding or extrusion blow moulding.

8	(b)(i)	Injection moulding  Description: Polymer granules loaded into hopper Archimedian screw moves the granules past the heaters where they soften Softened polymer builds up at the injection point, Archimedian screw moves back. When sufficient polymer has gathered the hydraulic ram moves the Archimedian 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.	9	Mark breakdown: Nothing worthy of credit **(0 marks)** Simple description with little detail. Diagrams are basic. **(1-3 marks)** Better description and diagrams using correct terminology. **(4-6 marks)** Fully detailed descriptor with accompanying diagrams, correct terminology etc. **(7-9 marks)** Any flash/sprue would be removed and mould must be in the shape of the product for 9 marks. If no diagrams, max 4 marks. If no description, max 4 marks.

8	(b)(ii)	Injection moulding is a fast process making it suitable for quickly producing the volume of tops required. Injection moulding produces complex 3D shapes so it is suitable for making the grip on the top/ water valve/screw thread. Injection moulding produces repeated accuracy across large batches which make it suited to volume production. Injection moulding is a thermoplastic process which makes it suitable for use with LDPE. Injection moulding produces little wastage which helps manufacturers meet eco-targets. Etc.	4	1-2 marks per relevant point. Award second mark where point is explained.

8	(c)	Possible answers may include: **Suitable retail packaging:** Product securely held in place, euro slot, recycling symbol, bar code, appropriate materials such as card based materials / thermoplastics / starch based or bio batch polymers / recycled materials. Use of minimal materials e.g. a sleeve design. Details of manufacture such as use of card nets, press knife, laser cut carton board, off-set lithography or digital printing, cutting formes, vacuum forming package, die cutters, crimping edges / staples etc. NB: Do not accept references to the use of PVA or hot melt glue gun. **Attracting the target market:** Use of colours, appropriate text, graphics, pictures of product in use, pictures of aspirational sports person using/endorsing the product, cut away section for consumer to touch the product etc. Give credit for features that add value to the package e.g. re-use of the package to store other items, eco-friendly aspects such as eco inks, minimal use of materials, recyclability etc. **NB Product must only hold one water bottle.**	12	Mark breakdown: Nothing worthy of credit **(0 marks)** Basic diagrams and simple notes about the product. Materials/ manufacture process uses non-specific terminology eg plastic, card, cut and fold into shape. **(0-4 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. **(5-8 marks)** Full development taking into account all points. Specific suitable materials and manufacture methods. Clear diagrams to show an appropriate design for a retail product. **(9-12 marks)** If no diagrams, max 6 marks.