Mark Scheme (Results)

Summer 2018

Pearson Edexcel GCE Advanced Subsidiary
In Design and Technology: Product Design
8DT0/01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Mark
1(a)	Any **two** valid benefits: 1. Sections have increased strength / adhesive is generally stronger than timber (1) 2. Thinner / shorter sections can be used / do not need 4m long lengths (1) 3. Sections can be bent more easily (1) 4. Laminated curved sections require less wood than cutting the beam from solid timber (1) 5. Less prone to natural faults (splits, knots, waney edge) (1) 6. Beams are more stable (1) 7. Beams can be made as deep as needed / not limited by timber sizes (1) 8. Formers can be re-used to produce identical beams (1) 9. The beam resists natural tendency to straighten (1)	**(2)**

Question number	Answer	Additional guidance	Mark
1(b)	Any **two** valid reasons with linked justification: 1. Provides a strong joint (1) so bridge can withstand a lot of weight / last a long time / be durable (1) 2. Dries quickly (1) which reduces manufacturing time (1) 3. Does not dry instantly (1) which allows time for positioning laminates / clamping in the former (1) 4. Water resistant version could be used (1) so suitable for outdoors / close proximity to water (1) 5. Requires no mixing / can be used straight out of the bottle (1) reducing waste / time (1) 6. Dries clear /does not discolour the wood (1) so cannot be seen / will not detract from aesthetics / beams do not require cleaning / colouring / staining (1) 7. Cheap (1) reducing overall costs (1) 8. Non-toxic (1) so safe to use / no need for PPE / more environmentally friendly (1)	Allow answers written in the negative referring to other adhesives which may be slow drying (1) which would reduce the production rate (1) Do not accept 'easy to apply' as this is too vague.	**(4)**

Question number	Answer	Additional guidance	Mark
1(c)	**Two** composite materials from: 1. Plywood (1) 2. Medium density fibreboard (MDF) (1) 3. Blockboard (1) 4. Laminboard (1) 5. Chipboard / oriented strand board / particle board (1)	Do not accept **hardboard** or any non-wooden composite.	**(2)**

Question number	Answer	Additional Guidance	Mark
1(d)	Candidates will need to recognise that each of the following stages are required. **<u>Method A – Calculate recesses</u>** **Stage 1:** Change dimensions from mm to cm (1) **Stage 2:** Identify height of beam recess 20 – 4 - 4 = 12cm (1) **Stage 3:** 12 x 60 x 1 = 720cm^3 (1) **Stage 4:** 720 x 2 (1) = 1440cm^3 (1) **<u>Method B – Subtract I beam from solid</u>** **Stage 1:** Change dimensions from mm to cm (1) **Stage 2:** Volume of solid beam 4 x 20 x 60 = 4800cm^3 (1) **Stage 3:** Volume of I beam 20 – 4 - 4 = 12cm 12 x 60 x 2 =1440cm^3 4 x 4 x 60 = 960cm^3 1440 + 960 + 960 = 3360cm^3 (1) **Stage 4:** Solid beam minus I beam 4800 – 3360 = 1440cm^3 (1)	Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(4)**

Question number	Answer	Additional Guidance	Mark
2(a)	**One** mark for the identification of each stage of the process: 1. A machine file / STL file is created from the CAD drawing (1) 2. A schematic / simulation test is run to generate tool path (1) 3. CAD file is downloaded to the router (1) 4. Enter material type / size / feed / speed rates (1) 5. Get correct sizes blank (1) 6. The blank / material is placed / fixed in position / aligned (1) 7. Material height entered (1) 8. Cutter/s is/are selected/fitted in router/ multi-tool holder (1) 9. Guard / machine doors closed (1) 10. Extraction turned on (1) 11. Cutter is zeroed / homed / set / reset (1) 12. The cutting starts / press start (1)	Accept these in any order as many are interchange-able in terms of the order in which they happen. Note Pt.7 is for selecting / fitting the cutter, not just using it.	**(6)**

Question number	Answer	Additional guidance	Mark
2(b)	Any **three** explanations that include identification of a performance characteristic (1), and linked justification of that performance characteristic (1). 1. Strong / strength (1) to resist static forces / breaking / splitting (1) 2. Tough (1) can withstand impacts / knocks (1) 3. Hard (1) so wont dent / scratch / wear away easily during use (1) 4. Dense / tight / close / narrow / straight / fine / interlocking grain (1) so high definition machining is possible / reduced splintering / smooth / polished surface achievable (1) 5. Stable (1) so won't distort / warp (1) 6. Heavy (1) so won't move around in use (1) 7. Durable / hardwearing (1) so will last a long time. (1)	Only accept the given justifications on this question. Do not accept the general term 'damage' more than once.	**(6)**

Question number	Answer	Mark
2(c)	**Two** materials from: 1. Polyethylene / PE / HDPE / LDPE / XLPE (1) 2. Polypropylene / PP (1) 3. Polyvinyl chloride / PVC (1) 4. Nylon (1) 5. Thermoplastic Polyester Elastomers / TPE (1) 6. Polycarbonate / PC (1)	**(2)**

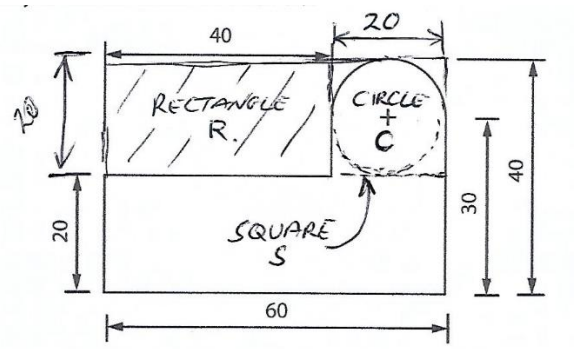
Question number	Answer	Additional guidance	Mark
2(d)	Any **two** explanations that include identification of a benefit (1) and linked justification of that benefit (1). 1. The board would be made hollow (1) reducing the weight of the game (1) 2. It uses less material (1) reducing costs / cost of the game. (1) 3. Cheap moulds / reduced capital outlay (1) as they are quicker to produce / made from sheet metal / need no draft angles. (1) 4. No sprues /runners present (1) so no secondary processing needed / no waste / no unsightly marks (1) 5. Mouldings are stress free / less likely to split or crack (1) so the game is stronger / tougher / more durable / likely to withstand rough handling / dropping. (1)	Do not accept any answers which refer to other plastic forming processes (e.g. extrusion, blow moulding). Do not award '**cheaper**' unless qualified as per Pt.2 or 3.	**(4)**

Question number	Answer	Additional guidance	Mark
3(a)	Any **two** explanations that include identification of an advantage (1) and linked justification of that advantage (1). 1. An extra process is required (joining / welding) (1) which takes more time / more labour / more equipment / costs more (1) 2. Welding produces a fillet / visible joint (1) which may compromise the shape / aesthetics / need removing (1) 3. It gives a stronger component / less likely to break (1) as there is no joint / no weak point (1) 4. More likely to be accurate (1) as parts do not need aligning (1)	Allow answers written in the negative. E.g. No extra process is required (1) which saves costs. (1) Do not accept repeated justifications.	**(4)**

Question number	Answer	Mark
3(b)	**Two** advantages given from: 1. Reduced amount of material cut away (1) 2. Less discarded if either component is defective (1) 3. The two parts can be machined simultaneously / prepared separately / in separate workshops / areas / by different people (1) 4. Less money tied up in stock / smaller stock sections (1)	**(2)**

Question number	Answer	Additional guidance	Mark
3(c)	Any **two** explanations that include identification of an advantage (1) and linked justification of that advantage (1). 1. Durable / lasts a long time (1) does not fade / so will not flake / peel / chip / so does not need repeating / recoating (1) 2. More scratch resistant (1) as it penetrates into the surface / add a harder layer to the surface (1) 3. Negligible thickness (1) so holes do not get clogged / do not need cleaning out / does not prevent it functioning / more accurate tolerances possible (1) 4. Fully covers every surface (1) as anodising fluids fully penetrate holes (1)	Allow answers written in the negative referring to the dis-advantages of paint over anodising e.g. paint may flake / peel (1) so will need recoating (1).	**(4)**

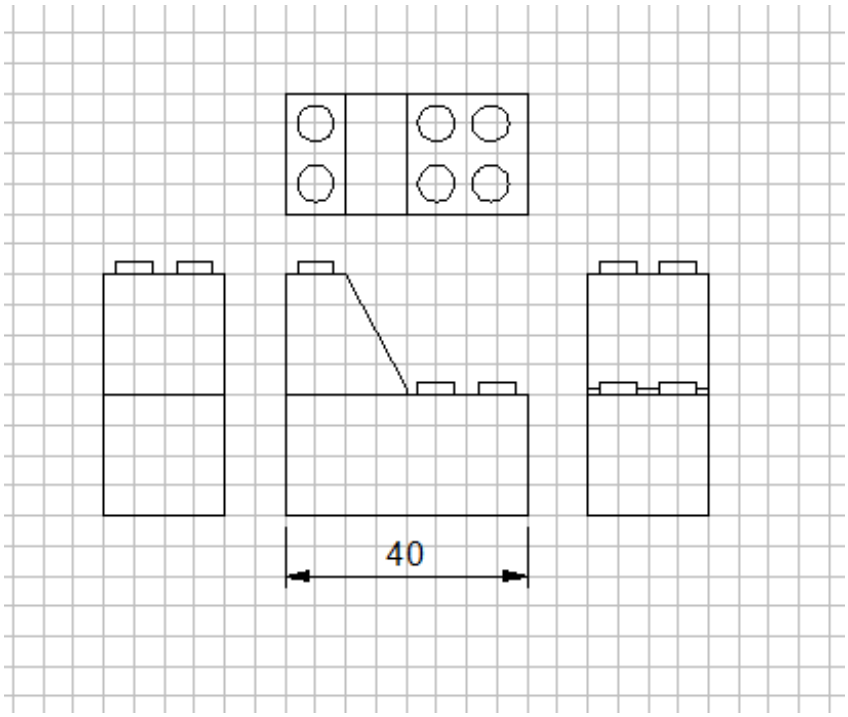
	5. Less skill to apply (1) as no risk of drips or runs / brush strokes / as it gives a very even coverage. (1) 6. Heat resistant (1) so can be used in situations where paint would blister (1)		

Question Number	Answer	Additional guidance	Mark
3(d)	Candidates need to recognise that each of the following stages are required:  **<u>Method A – Volume of waste</u>** **Stage 1:** Volume of rectangle R 40 x 20 x 100 = 80,000mm^3 (1) **Stage 2:** Volume of circle C = π R^2 H 3.142 x 10^2 x 100 = 31,420mm^3 (1) **Stage 3:** Volume of square S 20 x 20 x 100 = 40,000mm^3 (1) **Stage 4:** Volume of four corners = S – C 40,000 - 31,420 = 8,580mm^3 (1) **Stage 5:** Volume of top two machined corners 8580 / 2 = 4,290mm^3 (1) **Stage 6:** Total volume of waste = R + 2 corners 80,000 + 4,290 = **<u>84,290 mm^3</u>** (1) **<u>Method B – Area subtraction</u>** **Stage 1:** Area of original block cross section 40 x 60 = 2,400mm^2 (1) **Stage 2:** Area of lower rectangles (20 x 60) + (20 x 10) = 1400mm^2 (1) **Stage 3:** Area of semicircle = π R^2/ 2 3.142 x 10^2 / 2 = 157mm^2 (157.07) (1) **Stage 4:** Total area of block 1,200 + 200 + 157 = 1557mm^2 (1)	Accept answers between **84,290mm^3** and **84,300mm^3** Due to differing values of π and calculation methods. Accept alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only.	**(6)**

	Stage 5: Areas wasted 2,400 – 1557 = 8423mm^2 (1) **Stage 6:** Volume wasted 8423 x 100 = **<u>84300mm^3</u>** (1)		

Question number	Answer	Mark
4(a)	Any **two** explanations that include an identification of a characteristics (1) and two linked justifications of that performance characteristic (1) + (1). 1. Can be produced in a wide range of colours (1) a) so does not need a coloured finish to be applied (1) b) and keeps production costs low (1) c) making it more visually appealing to children (1) d) as they are able to produce more interesting / realistic / wider range of models (1) e) increasing users engagement (1) 2. Very mouldable / malleable / good plasticity / thermoplastic(1) a) so suitable for injection moulding (1) b) which enables mass / fast production (1) c) so meeting large demand (1) d) which means that high definition / accurate / smooth mouldings are possible (1) e) so there is a good fit between the bricks / bricks easily separated (1) 3. Durability (1) a) extending the life of the toy (1) b) so new purchases are not necessary (1) 4. Strength / toughness / robustness (1) a) meaning it can withstand a lot of use / abuse / force / knocks without breaking (1) b) as children often play roughly (1) c) therefore no sharp edges will be created (1) 5. Hardness (1) a) so it is scratch / dent / wear resistant (1) b) so no build-up of bacteria in scratches (1) 6. Elasticity (1) a) so the bricks grip together effectively (1) b) allowing large / complex models(1) 7. Lightweight (1) a) so models do not become too heavy for a child to lift (1) b) which could lead to injuries (1) 8. Chemical / water resistance (1) a) so bricks can be easily cleaned / washed if they become dirty (1) b) Which improves hygiene / heath issues (1) 9. Non Toxic (1) a) therefore inert (1) b) which makes them safe (if a child puts them in their mouth) (1)	**(6)**

Question number	Answer	Mark
4(b)	A 3rd angle orthographic projection that includes an image drawn with a ruler or free hand. Marks to be awarded for the following.	**(8)**



Level	Mark	Descriptor
	0	No rewardable materials
Level 1	1 – 2	• Drawing is produced with limited attention to detail and lacks accuracy and precision. • Views inappropriately located. • Some features of the drawing may be included but lack detail and may be inappropriately positioned. • Line style is inconsistent and inappropriate throughout.
Level 2	3 – 5	• Drawing is produced with some precision and accuracy. • Most views in correct position with correct alignment. • Most drawing features are detailed with correct positioning and appropriate proportions. • Line style is broadly consistent and appropriate throughout.
Level 3	6 - 8	• Drawing is produced with precision and accuracy. • All views in correct position with correct alignment. • Drawing features are fully and correctly detailed with correct positioning and proportions. • Line style is consistent and appropriate throughout.

Question number	Answer	Mark
4(c)	Any **two** explanations that include identification of a reason (1) and linked justification of that reason (1). 1. Rapid process / a large number can be made quickly (1) 2. The die is re-used over and over again (1) 3. Gives a high quality surface finish (1) 4. The blocks are more appealing / attractive / have good aesthetics (1) 5. The detail required can achieved (1) 6. No further processes are required (1) 7. Consistent / repeated accuracy / reliable process (1) 8. Minimal waste / few rejects (1) 9. Automated process (1) 10. Minimal labour needed (1) 11. Cheap method of production (1) 12. Gives a strong / robust / durable component (1) 13. Aluminium has a relatively low melting point (1) 14. The die will not degrade quickly / will last a long time (1) 15. The simple shape of the die will not be too expensive to produce (1) 16. High cost of the die is spread over many castings (1)	**(4)**

Question number	Answer	Additional guidance	Mark
4(d)	Candidates need to recognise that each of the following stages are required: **Stage 1:** Volume of block 40 x 20 x 4 = 3,200mm^3 (1) **Stage 2:** Volume of pin 4.142 x 3^2 x 2 = 56.556mm^3 (1) **Stage 3:** Volume of 8 pins 56.556mm^3 x 8 = 452.448mm^3 (1) **Stage 4:** Volume of hole 3.142 x 1.5^2 x 4 = 28.278mm^3 (1) **Stage 5:** Total volume of brick 3,200 + 452.448 – 28.278 = 3,624.17mm^3 (1) **Stage 6:** Total volume for 5000 bricks 3,624.17 x 5000 = **18,120,850mm^3** (1)	Accept Alternative methods of correct working out. Error carried forward should be applied. Award full marks for correct answer only. Accept answers between **18,120,575mm^3** and **18,120,850mm^3** due to differences in the value of π.	**(6)**

Question number	Answer	Additional guidance	Mark
5(a)	**AO4 2a = 4 marks, AO4 2b = 4 marks** Candidates are required to outline the principles which influenced designers during the Arts and Crafts period. Candidates might refer to the following in their responses: 1 Form follows function 2 Simplicity – removal of clutter 3 Aimed to be affordable – Within reach of the masses, but rarely achieved 4 Proportion – suitable size for current living conditions / not oversized 5 Minimal decoration – humble / simple construction / rustic 6 Experimentation with materials / techniques 7 Preference for natural materials / beauty of natural materials 8 Use unusual materials and precious metals 9 Natural forms – plants / birds / animals 10 Stylisation / symbolism / patterning / Medieval styles / stylised flowers / Celtic motifs / hearts / sailing ships 11 Colour – used to provide unity and focus / highly decorated / coloured small areas 12 Link between colour and nature 13 Empowered people to design / make their own products / handmade 14 Splendour and simplicity 15 Were against industrially produced bland designs 16 High quality / long lasting / handed down.	**Do not award** references to 'Crafts-manship' as this is in the stem	**(8)**

Marking instructions
A maximum of 4 marks can be awarded for demonstration of knowledge in isolation without linked understanding.

Level	Mark	Descriptor AO4
	0	No rewardable content
Level 1	1–2	• Superficial response that demonstrates basic knowledge of a narrow range of relevant factors. • Makes tentative connections between factors discussed, demonstrating a limited understanding of the design concept.
Level 2	3–5	• Coherent response demonstrating competent knowledge of a sufficient range of relevant factors. • Makes sound connections between factors discussed, demonstrating a competent understanding of the design concept.

Level 3	6–8	• Comprehensive response demonstrating thorough knowledge of a wide range of relevant factors. • Makes effective connections between factors discussed, demonstrating a thorough understanding of the design concept.

Question number	Answer	Additional guidance	Mark
5(b)	Any **two** explanations that include identification of a way (1) and linked justifications of that way (1). 1 Comfortable / comfort is key (1) cushioned / fabric covered seating surfaces / arm rests (1) 2 Ergonomically shaped / supports user in a relaxed posture (1) reclined angle of seat and back / shaped uprights follow contours of a person's back / high back gives full support to back and neck / avoids back pain / strain (1) 3 Anthropometrically designed / takes into account human dimensions (1) suitable height seat / back (1) 4 Easy to move about (1) casters added to feet (1) 5 Stability / will not tip easily (1) as the base of the chair is relatively large / long back legs (1) 6 Sturdy, robust, chunky structure (1) as braces interlink all components / that will withstand long term use / users sitting down heavily (1) 7 Little artificial decoration added / every part has a function (1) resulting in simple / humble styling.	Accept rationalised negative alternatives to the positives stated in the mark scheme and visa-versa.	**(4)**

Question number	Answer	Additional guidance	Mark
6	Any **two** explanations that include identification of a positive effect (1) and linked justifications of that positive effect (1) + (1). 1 a) Consumers buy up to date products / stay in fashion (1) b) due to regular / frequent new releases (1) c) increased consumer satisfaction / pleasure(1) d) consumers want to be seen with the latest product / one-upmanship (1) 2 a) Consumers have a wider choice (1) b) due to increased competitiveness between businesses (1) c) leading to competitive prices (1) d) can plan / budget for replacement (1) e) increased second hand market (1) 3 a) Drives innovation / new / improved features / multi-function products are developed (1) b) which can improve consumers quality of life (1) c) improved safety features / consumers are safer (1)	**Do not reward** an explanation of built-in obsolescence if it is not a positive for the consumer. Do not award references to **safety** unless linked to added features of upgraded products.	**(6)**

Question number	Answer	Mark
7	**AO3 1a = 4 marks, AO3 1b = 8 marks** Candidates should evaluate the user requirements of the two tin openers. Some points of expansion may link to any of the identified impacts. **Points for expansion:** • power • safety • hygiene • aesthetics • ergonomics • Anthropometrics • durability • materials • ease of use • cost. **Impacts:** • the speed of opening a tin • the efficiency in terms of energy used to open a set number of tins – mention of need to change batteries/cost of batteries • storage – size/weight • length of life/corrosion/sharpness • ease of cleaning / maintenance • method of operation – need to hold the tin/use of one or two hands/balance • safety – sharp edges • left/right handed operation • the finishes applied. • Weak wrists of elderly / disabled / injured • Manual is multifunction tin / bottle opener	**(12)**

Level	**Mark**	**Descriptor AO4**
	0	No rewardable content.
Level 1	1–3	• Applies a basic understanding to deconstruct information, making limited connections between concepts. • Incomplete evaluation with unresolved conclusion that demonstrates limited synthesises of understanding. • Judgements are tentatively supported by evidence.
Level 2	4–6	• Applies a generally sound understanding to deconstruct information and provide some clear connections between concepts. • Imbalanced evaluation that synthesises some relevant understanding into a generally coherent conclusion. • Judgements are occasionally supported by relevant evidence.
Level 3	7–9	• Applies an effective understanding to deconstruct information and provide logical connections between concepts. • Balanced evaluation that synthesises relevant understanding into a considered conclusion. • Judgements are mostly supported by relevant evidence.

Level 4	10–12	• Applies a comprehensive understanding to deconstruct information and provides insightful connections between concepts throughout. • Thorough and balanced evaluation that synthesises relevant understanding into a well-developed conclusion. • Judgements are supported by pertinent evidence throughout.