Cambridge Assessment International Education

Cambridge International A Level

DESIGN AND TECHNOLOGY **9705/33**

Paper 3 **October/November 2020**

MARK SCHEME

Maximum Mark: 120

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks	Guidance
Section A Part A – **Product Design**			
1(a)	suitable material: • abs/polypropylene/acrylic • plywood • MDF • aluminium alloy reasons: • can be fabricated to required shape • will not scratch when removing contents • any other reason appropriate to material choice	**3**	
1(b)	quality of description: • fully detailed all/most stages [4–7] • some detail, [0–3] quality of sketches up to [2]	**9**	*Fabrication* *Pieces marked out and cut accurately to shape* *Drill* Ø25 hole (forstner bit, hole cutter) Accept detailed set up of laser cutter *Could be butt joint and glued with PVA for plywood and MDF* *Could be biscuit or tongue insert* *Tensol cement or other appropriate solvent for acrylic* *Thermoformed acrylic over former* *Solvent for polypropylene and ABS* *Careful clamping, clean up* *Set* *Final finish*

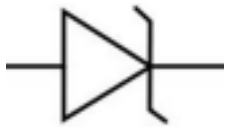
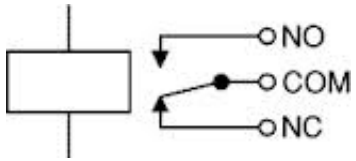
Question	Answer	Marks	Guidance
1(c)	explanation could include: • change in process • change in materials • use of jigs, formers, moulds • simplification of design quality of explanation: • logical, structured [4–6] • limited detail [0–3] quality of sketches up to [2]	**8**	*Marks awarded for correct use of templates, formers and jigs* *Cutting parts to length / shape* *Folding / bending / holding whilst being joined* *Hole could be drilled before or after bend, if after, ensure correct support for drilling* *Injection moulding not appropriate for batch of 100 – award up to 3 marks for full description of producing box using injection moulding*

Question	Answer	Marks	Guidance
2	Discussion could include: environmental • conservation of resources/energy • protection of environment economic • production / material costs • sales cultural • appropriate for market • appropriate colour/symbols examples / evidence could be • re-use, recyclability etc. • impact on rain forest, increased use of bamboo, issues with plastic • specific product/material production costs • specific cultural examples – e.g. eating utensils examination of issues • wide range of relevant issues [5–8] • limited range [0–4] quality of explanation • logical, structured [4–8] • limited detail, [0–3] supporting examples / evidence [4]	**20**	*All areas covered to access full marks*

Question	Answer	Marks	Guidance
3(a)	description of process • fully detailed, all / most stages [3–5] • some detail, [0–2] quality of sketches up to 2 2 × [7]	**14**	*Stages could include:* ***Die casting*** *Die prepared, heated* *Molten zinc poured* *Sufficient time for cooling* *Release and trim* *Apply final finishing* ***GRP*** *Mould prepared, release agent applied* *Gel coat applied* *Fibre glass layer applied with polyester resin, stippled and rolled* *Apply another layer of fibre glass if required* *Allow to set* *Remove and clean edges* ***Mortice and tenon*** *Mark out tenon* *Cut tenon using tenon saw* *Mark out mortice* *Drill or chisel most waste* *Tidy up joint with chisel* *Check for fit – pare if necessary* *Glue and clamp joint*

Question	Answer	Marks	Guidance
3(b)	Die casting • good finish achieved • basic shape, easy to remove from mould • minimal additional finishing required • accurate GRP • Compound shape • Structurally strong • Any colour applied • Excellent outer finish Mortice and tenon • Very strong joint • Ample gluing area • Neat joint, no gaps if cut correctly 2 × [3]	**6**	

Question	Answer	Marks	Guidance
Part B – **Practical Technology**			
4(a)(i)	Equilibrium. – a state in which opposing forces are balanced	**3**	Accept other correct mathematical or scientific definitions 2 marks for explanation / communication 1 mark for reference to structure
4(a)(ii)	Resolution of forces – combining two or more forces into a single resultant force	**3**	Accept other correct mathematical or scientific definitions 2 marks for explanation / communication 1 mark for reference to structure
4(a)(iii)	Triangulation – creating triangular structures (very strong) to improve stability of structures	**3**	Accept other correct mathematical or scientific definitions 2 marks for explanation / communication 1 mark for reference to structure
4(a)(iv)	Monocoque – shell structure – load supported through external skin	**3**	Accept other correct mathematical or scientific definitions 2 marks for explanation / communication 1 mark for reference to structure
4(b)	explanation could include: • Strain gauges, ultra-sonics • Large and expensive structures – costly to test to destruction • Safety implications • Planned timetable of regular testing quality of explanation: • detailed, logical, structured [6–8] • some detail [3–5] • limited detail [0–4]	**8**	Correct reference to input and output 2×2

Question	Answer	Marks	Guidance
5(a)	$I = \frac{V}{R}$ [1] = $\frac{9}{270}$ = .033 = 33.3 mA [1]	**2**	
5(b)	 Reed switch – Magnetic switch, e.g. door / burglar alarms  Darlington pair – Darlington pair uses two transistors are connected to obtain large gains e.g. Audio amplifier, LED driver  Zener diode – blocks current in the reverse direction, but will suffer from premature breakdown or damage if the reverse voltage applied across becomes too high – unlike a conventional diode as soon as the reverse voltage reaches a pre-determined value, the Zener diode begins to conduct in the reverse direction.  Relay – is an electrically operated switch often using an electromagnet to operate a switching mechanism mechanically. e.g. switching on a 240v pump. 3 × [3]	**9**	Clear description of the working 3 Some detail 0–2

Question	Answer	Marks	Guidance
5(c)	Greenhouse Clear understanding of use of a thermistor [1] in a circuit to open or close vents [1] to monitor heat [1] Illumination Could be use of an LDR [1] to dim or raise [1] light level [1] Water level Using open contacts [1] so that when water completes circuit [1] taps stopped [1] 3 × [3]	**9**	Award 3 marks for clear understanding of sensors

Question	Answer	Marks	Guidance
6(a)	Description of process • fully detailed all / most stages [3–4] • some detail, [0–2] quality of sketches up to 2 2 × [6]	**12**	*Process stages could include* <u>*Plastic (resin) casting*</u> *Prepare flexible mould (can be latex or rubber)* *Mix two-part resin* *Pour* *Vibrate to remove any bubbles* *Allow to set* *Remove* <u>*Parting off on lathe*</u> *Secure bar or length of wood (3 jaw chuck or between centres) part off as close to chuck as possible* *Set parting tool at centre height* *Wearing correct protective clothing turn on machine and cut at a slow but regular pace – use coolant* *Slower rate of cut near to when parting almost complete* <u>*Blow moulding.*</u> *Prepare split mould* *Extruded heated parison positioned in mould* *Clamp mould* *Blow in air* *Open mould – remove and trim*

Question	Answer	Marks	Guidance
6(b)	Clear understanding of electric welding [2] Clear understanding of gas welding [2] Examples [2] Comparisons drawn [2]	**8**	*Electric welding (Arc, MIG, TIG spot})* *Arc welding requires stream of electricity between the workpiece and an electrode* *Gas welding (oxyacetylene)* *Uses fuel gases to provide heat to weld* *Comparisons* *Gas simple set up and can be generally smaller Electric welding considered safer and produces better weld – no warping*

Question	Answer	Marks	Guidance
Part C – **Graphic Products**			
7	scale [2] correct planometric [2] windows [2] teacher's bench [2] locker unit [2] tables [3] sink [2] work top [2] accuracy / line quality [3]	**20**	

Question	Answer	Marks	Guidance
8	explanation could include: bar chart – presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent. Tables – are structured for organizing and displaying information, with data arranged in columns and rows. Information is displayed as text, using words and numbers, and grid lines may be present or not. Pictogram – image resembles what they signify Graphs – diagrams showing the relationship between variable qualities by means of a line, curve or series of bars or other symbols. Typically two variables, measured along a pair of axis (X and Y) at right angles to each other. Intersect is called the origin, usually only north east quadrant used. quality of explanation: • logical, structured [3–4] • - limited detail [0–2] 4 × [4] quality of sketches up to [4]	**20**	

Question	Answer	Marks	Guidance
9	Discussion could include: • clear understanding of using computers to generate ideas • clear understanding of opportunities for collaborative work • clear understanding of integration of costing, stock control and production • wide range of specialists can work on same project, engineers, architects, • quick and accurate costing, JIT stock control, ability to send direct to CAD • speed, ability to change and share ideas examples / evidence could be • specific CAD usage • specific product development • work of specific companies • examples of CAM usage examination of issues • wide range of relevant issues. [5–8] • limited range [0–4] quality of explanation • logical, structured [4–8] • limited detail [0–3] supporting examples / evidence [4]	**20**	

Question	Answer	Marks	Guidance
Section B			
	Analysis Analysis of the given situation / problem. [0–5] Detailed written specification of the design requirements. At least five specification points other than those given in the question. [0–5] **Exploration** Bold sketches and brief notes to show exploration of ideas for a design solution, with reasons for selection. • range of ideas [0–5] • annotation related to specification [0–5] • marketability, innovation [0–5] • evaluation of ideas, selection leading to development [0–5] • communication [0–5] **Development** Bold sketches and notes showing the development, reasoning and composition of ideas into a single design proposal. Details of materials, constructional and other relevant technical details. • developments [0–5] • reasoning [0–5] • materials [0–3] • constructional detail [0–7] • communication [0–5] **Proposed solution** Produce drawing/s of an appropriate kind to show the complete solution. proposed solution [0–10] details/dimensions [0–5] **Evaluation** Written evaluation of the final design solution. [0–5]	**80**	