



# Cambridge IGCSE™

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**DESIGN AND TECHNOLOGY**

**0445/31**

Paper 3 Resistant Materials

**May/June 2023**

MARK SCHEME

Maximum Mark: 50

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**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 May/June 2023 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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This document consists of **9** printed pages.

**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
1	3 ergonomic features such as: shape of hand grip / ridges on chuck / easy to read settings / overall comfortable shape [3 × 1]	3	Accept any valid ergonomic features

Question	Answer	Marks	Guidance
2	Any 2 different appropriate methods: Use of wooden corner block / recognised KD fitting / dovetail nailing / dowels / screws / Pin & glue / screw & glue [3 marks]	3	Reward 2 different appropriate methods 3 marks Use of adhesive not required

Question	Answer	Marks	Guidance
3	<b>A</b> tin snips / snips OR metal shears / shears [1] <b>B</b> cold chisel /chisel [1]	2	

Question	Answer	Marks	Guidance
4	Datum face provides a perfectly flat surface [1] From which to measure, used to measure accurately [1]	2	

Question	Answer	Marks	Guidance
5(a)	PVC	1	
5(b)	Phenol formaldehyde	1	

Question	Answer	Marks	Guidance
6	Some form of strut [1] Method of joining strut to bracket: brazed / riveted] [1] Technical accuracy in notes and sketches [1]	3	

Question	Answer	Marks	Guidance
7	Hinge drawn in correct position [1] 2 leaves [1] 2 or 3 holes in each leaf [1]	3	

Question	Answer	Marks	Guidance
8	<b>A</b> injection moulding / 3D printing [1] <b>B</b> die-casting [1]	2	Do not reward 'casting'

Question	Answer	Marks	Guidance
9	Welding / brazing	1	

Question	Answer	Marks	Guidance
10	Recognised frame: 4 softwood strips [1] Size/proportion of strips [1] Corner joint for strips; e.g. butt joint / mitre joint, named <b>or</b> shown [1]  Method of joining frame to hardboard [1]	4	Strips must be applied to 'face of hardboard- not edges

Question	Answer	Marks	Guidance
11(a)(i)	Any 2 benefits such as: easy to work / relatively cheap / availability [2 × 1]	2	Accept any valid benefits
11(a)(ii)	Plywood / hardboard	1	
11(a)(iii)	PVC / ABS / polycarbonate / PET / polythene	1	
11(b)	Any 2 reasons such as : reduces costs if mistakes are made / check appearance / sizes / test mechanism [2 × 1]	2	Accept any valid reasons

Question	Answer	Marks	Guidance
11(c)	Marking out plastic [1] Saw plastic to shape: leaving small amount of waste to remove [1] Appropriate saws: band saw / Hegner saw / scroll saw / coping saw/ tenon saw [1] Edges made flat and smooth: files, disk sander, wet and dry paper [1] Accept any valid safety precaution relating to any <b>correct</b> process [1]	5	Do not accept jig saw  Do not accept glasspaper/sandpaper
11(d)	Mark out 40 x 40 piece of MDF [1] Cut to disk shape, leaving small amount of waste to remove [1] File/sand to finished shape [1] Holes drilled correctly [1] Correctly named tools and equipment [1]	5	Accept use of hole saw: Hole saw named [1] Hole saw drawn [1] Mark centres on 40 × 40 piece of MDF [1] Description of use [0 – 2]
11(e)(i)	Benefit: quick to apply and join parts / no clamping required [1]  Drawback: can be 'messy' / no adjustment of joints possible / not as strong as PVA type adhesives / difficult to remove excess adhesive /, toxic fumes [1]	2	
11(e)(ii)	Thin layer of contact adhesive applied evenly to both surfaces to be joined [1] Allow to 'touch dry' before joining two surfaces together [1]	2	2 clear stages
11(f)	Recognised easy access 'lid' design [1] Appropriate constructions shown or named [0 – 2] Sizes to confirm lid fits [2 × 1]	5	Outside dimensions: 100 × 50 Inside dimensions: 80 × 30

Question	Answer	Marks	Guidance
12(a)	Acrylic can be reheated and shaped whereas thermosets can only be heated and shaped once.	1	
12(b)(i)	Scriber / chinagraph pencil / marker pen [2 × 1]	2	
12(b)(ii)	Tenon saw / coping saw / Hegner saw or equivalent / band saw / hacksaw [2 × 1]	2	

Question	Answer	Marks	Guidance
12(c)	Any 2 precautions such as: acrylic sheet must be clamped securely / high drill speed / sacrificial board under acrylic sheet / care taken with pressure applied [2 × 1]  Technical accuracy showing acrylic on table of drilling machine [1]	3	Accept any valid precaution Do not accept PPE/safety glasses
12(d)(i)	Strip heater	1	Accept line bender
12(d)(ii)	Acrylic positioned on line bender or strip heater [1] Use of a former or equivalent to produce correct bend [1] Method of retention while acrylic cools [1]	3	
12(e)	Support locked at 4 positions [1] Method of locking [0 – 2] Named materials [1] Technical accuracy: e.g. constructions and fittings used [1]	5	Reward designs that focus on locking at the pivot point with discreet 10°, 20° and 30° positions <b>or</b> use a strut fitted against the back of the support to provide the tilted angles
12(f)(i)	Any 2 benefits: stainless steel is attractive / extremely hardwearing / does not corrode / self-finished [2 × 1]	2	
12(f)(ii)	Stainless steel sheet is clamped appropriately [1] Use of a former or equivalent [1] Method of force: hammer and scrap wood or hide mallet [1] Correctly named tools and equipment [1]	4	Accept use of sheet metal folder with details described fully
12(g)	Any 2 benefits of CAD such as: on-screen editing / on-screen modelling of 'tilt' positions / CAD drawing linked to CNC machine to transfer data / faster [2 × 1]	2	Accept any valid benefits

Question	Answer	Marks	Guidance
13(a)	Materials and equipment to store / their sizes / quantity of materials/equipment / location/environment [2 × 1]	2	Accept any valid items of research Do not accept one-word answers
13(b)	1 Made from quality materials [1] 2 Easy access to equipment [1] 3 Strong constructions [1]	3	
13(c)(i)	Benefit of template: speed / repetitive accuracy	1	
13(c)(ii)	5mm waste marked out to allow for the thickness of the saw kerf	1	Do not accept 'room for error'
13(c)(iii)	Band saw / jig saw / Hegner saw or equivalent	1	
13(d)(i)	Use of sanding disk / files / glasspaper / spokeshave [2 × 1]	2	
13(d)(ii)	Wood held securely in a vice or clamped securely [1] Planed to middle, stop and plane from opposite end <b>or</b> plane straight across with scrap wood at end of board [1] Technical accuracy of tools and equipment named [1]	3	Accept shooting board Look carefully at position of scrap wood
13(e)	Suitable construction: mortise and tenon [variants] / dowel  Award 0–3 marks dependent on technical accuracy: proportion, orientation Tenon with shoulders [max 3] Bareface (only mortise drawn) [max 2]	3	
13(f)	Drawer fits space <b>B</b> 122 × 30 × 100 [1] Constructions: corner joints named or shown [1] Constructions: base fitted to drawer [1] Appropriate hand hold clearly shown or identified [1]	4	
13(g)(i)	White polish / French polish / button polish / cellulose / Teak oil / Tung oil / wax / lacquer	1	Do not accept 'oil'
13(g)(ii)	Provides even pressure applied to surface / faster than using individual fingers/hand / allows a flat/even finish	1	

<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
13(g)(iii)	To avoid scratching the surface	<b>1</b>	Do not accept 'damages the wood', 'splinters', 'chips'
13(h)	Check against original specification / give the product to a third party to 'test' it out / place items for storage in desk tidy to check fit and access	<b>2</b>	Accept any valid method