



# Cambridge International A Level

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DESIGN AND TECHNOLOGY

9705/32

Paper 3

October/November 2021

MARK SCHEME

Maximum Mark: 120

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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 October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **17** printed pages.

**PUBLISHED****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
<b>Section A</b>			
Part A – <b>Product Design</b>			
1(a)	suitable material: <ul style="list-style-type: none"> <li>• brass, copper, silver, gold</li> <li>• aluminium alloy, stainless steel</li> <li>• attractive hardwood</li> <li>• abs, acrylic</li> </ul> reasons: <ul style="list-style-type: none"> <li>• attractive material, good finish</li> <li>• smooth finish, will not cause skin irritation</li> </ul> any other reason appropriate to material choice	<b>3</b>	
1(b)	quality of description: <ul style="list-style-type: none"> <li>• fully detailed all/most stages</li> <li>• some detail,</li> <li>• quality of sketches</li> </ul>	<b>4–7</b> <b>0–3</b> up to 2	<b>9</b> <i>Dependant on material chosen.</i>  <i>Laminated hardwood, e.g., rosewood.</i>  <i>ABS, polypropylene, acrylic thermoformed</i>  <i>Must show shaping, drilling, and bending of material</i>

Question	Answer	Marks	Guidance
1(c)	explanation could include: <ul style="list-style-type: none"> <li>• change in process.</li> <li>• change in materials.</li> <li>• use of jigs, formers, moulds.</li> <li>• simplification of design.</li> </ul> quality of explanation: <ul style="list-style-type: none"> <li>• logical, structured</li> <li>• limited detail,</li> <li>• quality of sketches</li> </ul>	<b>8</b>          4–6 0–3 up to 2	<i>Press formers, jigs for drilling and stamping.</i>



Question	Answer	Marks	Guidance
3(a)	description of process <ul style="list-style-type: none"> <li>• fully detailed, all/most stages</li> <li>• some detail,</li> <li>• quality of sketches</li> </ul>	14  3–5 0–2 up to 2 2 × 7	<p><b>shaping</b></p> <ul style="list-style-type: none"> <li>• <i>sawn to length with enough for grip in vice</i></li> <li>• <i>mark out rough profile</i></li> <li>• <i>shape using coping saw/ gouge or carving</i></li> </ul> <p><i>chisel and mallet</i></p> <ul style="list-style-type: none"> <li>• <i>spokeshave, curved rasp/coarse file to shape</i></li> <li>• <i>check with card profile templates</i></li> <li>• <i>finer file or spokeshave to final shape</i></li> <li>• <i>glasspaper with increasingly fine grit, with grain</i></li> <li>• <i>apply finish</i></li> </ul> <p><b>GRP layup</b></p> <ul style="list-style-type: none"> <li>• <i>prepare mould, apply release agent</i></li> <li>• <i>cut glass fibre matt to size</i></li> <li>• <i>catalyse and apply gel-coat to mould</i></li> <li>• <i>catalyse layup resin and apply to mould</i></li> <li>• <i>place and stipple first layer of glass fibre mat</i></li> <li>• <i>repeat until thickness is required</i></li> <li>• <i>wait until cure, trim</i></li> </ul>

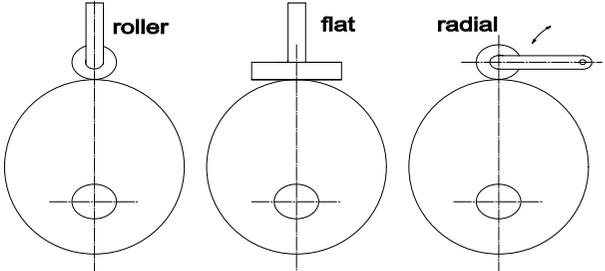
Question	Answer	Marks	Guidance
3(a)			<p><b>casting</b></p> <ul style="list-style-type: none"> <li>• <i>prepare pattern, male pattern required, high</i></li> </ul> <p><b>quality finish</b></p> <ul style="list-style-type: none"> <li>• <i>prepare mould, drag upside down on board, pattern face down in centre, parting powder, pack with sand, turn over</i></li> <li>• <i>fix cope, parting powder, pack and level</i></li> <li>• <i>add sprue pins, lift cope, remove pattern, cut channels from sprues</i></li> <li>• <i>replace cope, cut pouring basin to sprue</i></li> <li>• <i>pour molten aluminium, cool, extract and trim</i></li> </ul> <p><i>Accept other correct variations or methods.</i></p>
3(b)	<p>shaping</p> <ul style="list-style-type: none"> <li>• intricate, complex shapes achieved</li> <li>• high quality finish</li> <li>• unique bespoke items</li> </ul> <p>GRP layup</p> <ul style="list-style-type: none"> <li>• complex curves produced</li> <li>• very strong</li> <li>• any colour/finish</li> <li>• very good weathering</li> </ul> <p>casting – one piece, no need for assembly</p> <ul style="list-style-type: none"> <li>• limited wastage</li> <li>• finish can be applied</li> <li>• batches can be produced</li> </ul> <p style="text-align: right;"><math>2 \times 3</math></p>	<b>6</b>	<p><i>Accept other valid explanations, brief outline points max 3</i></p>

Question	Answer	Marks	Guidance
<b>Part B – Practical Technology</b>			
4	For each: valid product or structure quality of description and communication: <ul style="list-style-type: none"> <li>• detailed, structured</li> <li>• limited detail,</li> </ul>	1  2–3 0–1 5 × 4	20 <i>linkage transmit forces and motion, can change direction of movement, e.g., folding chair</i>  <i>lamination thin laminates bonded together over a former e.g., chairs, building arches</i>  <u>Rack and pinion</u> <i>Converts linear to rotary motion or vice versa. eg drilling machine.</i>  <u>Ratchet</u> often used with a pawl to allow rotation in one direction, e.g., ratchet screwdriver or spanner  <u>compound gear train</u> Compound gear trains involve several pairs of meshing gears. They are used where large speed changes are required or to get different outputs moving at different speeds, e.g., Vehicle, machine gearboxes

Question	Answer	Marks	Guidance
5(a)	See App1. Correct transposition to force diagram Correct direction of equilibrant force Correct magnitude of equilibrant force	up to <b>2</b> <b>1</b> <b>1</b>	<b>4</b>
5(b)	Ways could use braces, carefully placed additional beams  Example 1  quality of description and communication: <ul style="list-style-type: none"> <li>• detailed, structured</li> <li>• limited detail,</li> </ul>	2–3 0–1	<b>4</b>
5(c)	Discussion could include: <ul style="list-style-type: none"> <li>• effect of heat on structures, e.g., buckling, extension</li> <li>• effect of fatigue on structures, failure</li> <li>• impact of failure</li> <li>• safety</li> <li>• cost implications</li> </ul> examples / evidence could be <ul style="list-style-type: none"> <li>• specific examples</li> <li>• specific tests/checks</li> </ul> examination of issues <ul style="list-style-type: none"> <li>• wide range of relevant issues</li> <li>• limited range</li> </ul> quality of explanation <ul style="list-style-type: none"> <li>• logical, structured</li> <li>• limited detail,</li> </ul> supporting examples / evidence	3–5 0–2  3–5 0–2  2	<b>12</b>



Question	Answer	Marks	Guidance
<b>Part C – Graphic Products</b>			
7	Scale Door Window Sink and storage unit Mirror Wardrobe Desk and chair Bed and bedside cabinet Overall line quality	1 1 2 4 2 2 3 3 2	<b>20</b> <i>Incorrect projection maximum 10 marks</i>  <i>Accept 45° × 45° and 45° × 60°</i>

Question	Answer	Marks	Guidance
8(a)	See App 2 minimum diameter 40 in line knife edge follower clockwise direction 0° – 60° dwell 60° – 150° rise 40 simple harmonic motion 150° – 240° dwell 240° – 360° fall 40 uniform velocity Accuracy	1 1 1 2 3 3 3	<b>16</b>
8(b)	Cam followers could be:  flat roller radial	<b>2 × 2</b>	<b>4</b>  



Question	Answer	Marks	Guidance
<b>Section B</b>			
10, 11, 12	<p><b>Analysis</b> Analysis of the given situation/problem. [0–5]</p> <p>Detailed written specification of the design requirements. At least five specification points other than those given in the question. [0–5]</p> <p><b>Exploration</b> <i>Bold sketches and brief notes to show exploration of ideas for a design solution, with reasons for selection.</i> Range of ideas [0–5]</p> <p>Annotation related to specification [0–5] Marketability, innovation [0–5] Evaluation of ideas, selection leading to development [0–5] Communication [0–5]</p> <p><b>Development</b> <i>Bold sketches and notes showing the development, reasoning and composition of ideas into a single design proposal.</i> <i>Details of materials, constructional and other relevant technical details.</i></p> <p>Developments [0–5] Reasoning [0–5] Materials [0–3] Constructional detail [0–7] Communication [0–5]</p>	80	

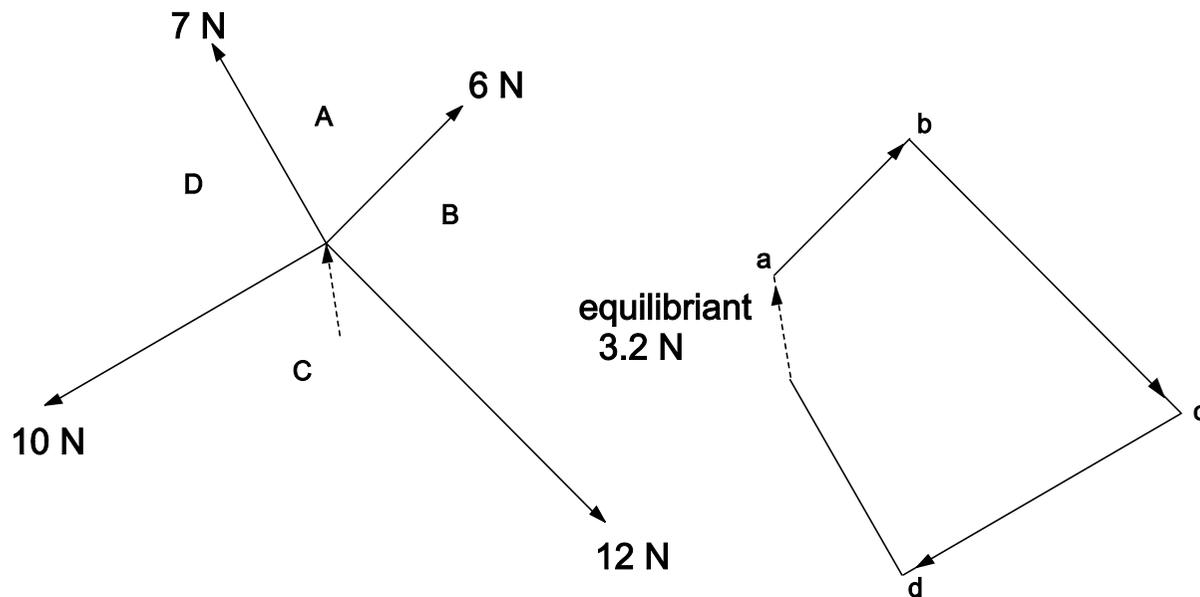
Question	Answer	Marks	Guidance
10, 11, 12	<p><b>Proposed solution</b>  <i>Produce drawing/s of an appropriate kind to show the complete solution.</i></p> <p>Proposed solution [0–10]            Details/dimensions [0–5]</p> <p><b>Evaluation</b>            Written evaluation of the final design solution. [0–5]</p>		

**App. 1**

**Q5 (a)**

Correct transposition to force diagram  
Correct direction of equilibrant force  
Correct magnitude of equilibrant force

up to 2  
1  
1



**App. 2**

