CAMBRIDGE
International Education

Cambridge IGCSE™

DESIGN AND TECHNOLOGY **0445/42**

Paper 4 Systems and Control **May/June 2025**

MARK SCHEME

Maximum Mark: 50

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 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 descriptions 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standard isation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

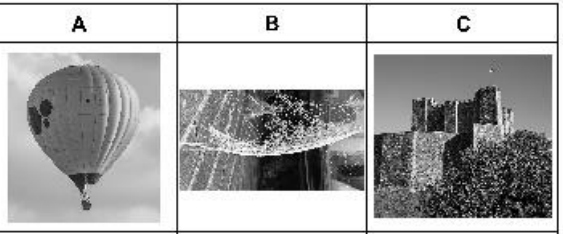
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Unclear
	Benefit of the doubt
	Incorrect point
	Error carried forward
N/A	Highlighting areas of text
	No benefit of doubt given
N/A	Off-page comment – allows comments to be entered off the page
	Repeat
	Indicates that the point has been noted, but no credit has been given
	Indicates that the point has been noted, but no credit has been given (big)

Annotation	Meaning
	Correct point
TV	Too vague
DET	Relevant detail

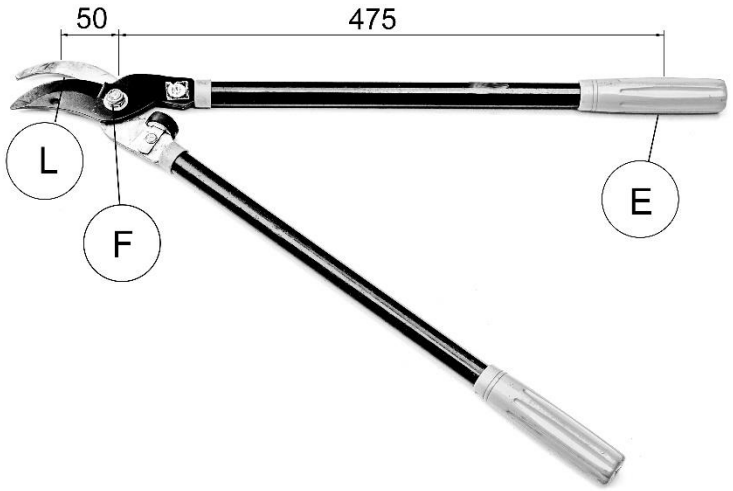
Question	Answer	Marks	Guidance
	Section A		
1	 A / B / C frame: B ✓ shell: A ✓ mass: C ✓ man-made: A ✓, C ✓ natural: B ✓ 1 mark for each correct tick	**6**	No marks for each item with more than two ticks added unless extra ticks are crossed out.6
2	Properties of steel will include: • ductile • durable • strength in tension • crush resistant • toughness • relative low cost. [2 × 1]	**2**	Allow other valid alternative properties. Do not allow: • 'strong' unless qualified • Rigid • Flexible • Corrosion resistant • Malleable.
3	**Triangulation**.	**1**	

Question	Answer	Marks	Guidance
4	Friction can be reduced by: • use of a streamlined / aerodynamic shape • making mating surfaces smoother • reducing contact between surfaces • use of efficient bearings • use of materials with a low coefficient of friction • reduced weight / parts count • accuracy in manufacture [2 × 1]	**2**	Accept any other valid response Description should relate to car design, do not allow reference to oil or grease.
5	Use of lubrication [1] With oil or grease [1] Reference to increased efficiency [1] [2 × 1]	**2**	1 mark for each valid point in the description. Allow 2 marks for a single point fully explained
6(a)	**A** – reciprocating motion **B** – oscillating motion **C** – rotary motion (accept circular) **D** – linear motion. [4 × 1]	**4**	
6(b)	Mechanisms could include: • Clock pendulum • Swing • Tuning fork • Bird's wings	**1**	Accept any other valid response Allow: Specific type of pendulum clock Crank and slider Bell crank
7(a)	A switch will electrically connect / disconnect parts of a circuit	**1**	Allow mark for understanding shown.
7(b)	Reed switch, [1]	**1**	
7(c)	A magnet [1] close to the switch will open / close the contacts. [1]	**2**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>8</td><td>
<table>
<tr><th>Value</th><th>Converted to volts</th></tr>
<tr><td>2.1 kV</td><td>2100 V</td></tr>
<tr><td>4 MV</td><td>4 000 000 V</td></tr>
<tr><td>20 mV</td><td>0.02 V</td></tr>
<tr><td>50 μV</td><td>0.00005 V</td></tr>
</table>
[3 × 1]
</td><td>3</td><td></td></tr>
</table>

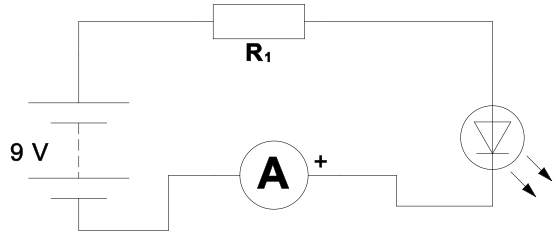
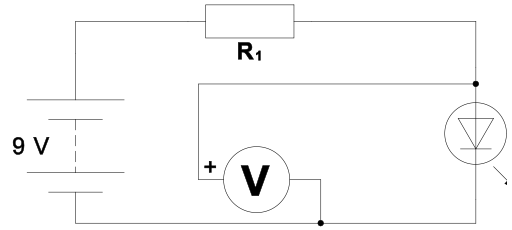
Question	Answer	Marks	Guidance
	Section B		
9(a)(i)	A moment is defined as: • The turning effect of a force. • Distance × Magnitude of force	**1**	Allow marks for understanding shown.
9(a)(ii)	Nm or Newton-metre	**1**	
9(a)(iii)	0.150 × 20 = 0.680 × **X,** [1] **X** = 3 / 0.680 = 4.41 N [1] **Any force greater than 4.41 N** will cause door to open. [1]	**3**	Award full marks if correct answer is given with no working.
9(b)	**A** **Benefit** no increased width to joint, no fixings to corrode, strong in tension, mechanical integrity. **Drawback** time taken to produce, over time wedges could work loose. **B** **Benefit** will align horizontally with 5 bolts preventing movement, simple joint can be produced on site, easily taken apart if necessary. **Drawback** increased width to joint / parts not in line, bolts become loose if wood shrinks. **C** **Benefit** pieces are in line, vertical movement prevented **Drawback** woodscrews could corrode or break, will resist compression but not tension. [6 × 1]	**6**	Allow other valid benefits / drawbacks

Question	Answer	Marks	Guidance
9(c)(i)	Laminating is: • The use of multiple layers of materials which could either be the same or different • Normally fixed with adhesive • Strength and stability are increased • Used to produce a rigid structure • Used to increase sound insulation.	**2**	1 mark for each valid point in the explanation. Allow 2 marks for a single point fully explained Do not accept reference to decorative laminates.
9(c)(ii)	Timber layers, plastic laminate sheeting, carbon fibre, named metals, GRP, paper or card. [2 × 1]	**2**	Allow any materials that are commonly combined in a structure. Do **not** allow the adhesives used.
9(d)(i)	Riveting has been used to join the roof supports.	**1**	
9(d)(ii)	Welding is: • Faster • Lower cost • Suitable for pre-fabrication • Precise method of joining	**2**	Accept any other valid response 1 mark for each valid point in the explanation. Allow 2 marks for a single point fully explained. Do not allow 'stronger'
9(e)(i)	Equilibrium is a state when all forces or moments are **balanced** or **equal**.	**1**	Allow mark for understanding shown.
9(e)(ii)	3 or 4 cables / fixings spaced around the flagpole [1] Fixings at ground level [1] Functional method. [1]	**3**	Accept any other valid method Flagpole must be supported from all directions for full marks
9(f)	Change in length = 2 mm Original length = 15 000 mm 1 mark for substitutions Strain = 2 / 15 000 [1] = **0.000133** [1] or **1.33 × 10^{-4}**	**3**	Award full marks if correct answer is given with no working.

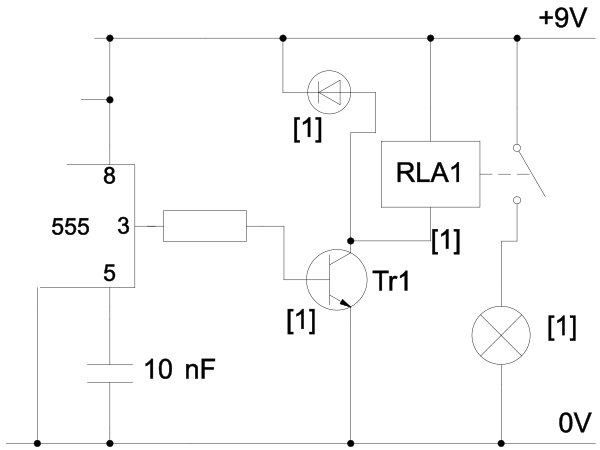
Question	Answer	Marks	Guidance
10(a)(i)	It is a **first order** or **first class** lever	**1**	
10(a)(ii)	 1 mark for each correct label	**3**	Do not allow mark for an identification that appears more than once.
10(a)(iii)	Maintenance will include: • Lubrication of the blades • Sharpening the blades • Adjustment of centre nut • Cleaning the blades	**2**	1 mark for each valid point in the description. Allow 2 marks for a single point fully described.
10(a)(iv)	Mechanical advantage = **475 / 50** [1] = **9.5** [1]	**2**	
10(b)(i)	720 º = 2 rotations, [1] For two turns of the crank handle to drill table will move (2.5 × 2) mm. = **5 mm** [1] The direction of movement is **upwards** [1]	**3**	

Question	Answer	Marks	Guidance
10(b)(ii)	Reasons for choice of rack and pinion will include: • The table is heavy and with the gear system it cannot slip / fall. • Precise movement is possible / good control over the height • Rack can run the full length of the pillar • High mechanical advantage • Rack can resist full weight of the table.	**2**	1 mark for each valid point in the explanation. Allow 2 marks for a single point fully explained.
10(b)(iii)	Description may include: • A plain bearing can allow sliding or rotation of the shaft within it. • Can be made from a range of materials • Only has one component in it • There are no moving parts • Will not prevent thrust	**2**	1 mark for each valid point in the description. Allow 2 marks for a single point fully justified.
10(b)(iv)	• Generally low cost • Replaceable when worn • Low maintenance	**2**	Accept any other valid response
10(b)(v)	• The rack should be kept clean and free from swarf. • Lubrication • Using grease rather than oil [2 × 1]	**2**	

Question	Answer	Marks	Guidance
10(c)(i)	Explanation could include: an idler gear: • Will transfer motion / torque from one gear to another after being placed • Is placed between the input and output shafts [1] • Will cause two shafts to rotate in the same direction when placed between them [1] • Will not alter the relative speed of the shafts that it connects. [1] • Can vary distance between input and output shafts [1]	**3**	1 mark for each valid point in the explanation. Allow 2 marks for a single point fully explained.
10(c)(ii)	Ratio of driver: driven= **25:15** = **1.6667** [1] Driver speed = 150 rpm Driven speed = 1.6667 × 150 = **250 rpm** [1] Gear **B** will rotate **anticlockwise** [1]	**3**	Award full marks if correct answer is given with no working.

Question	Answer	Marks	Guidance
11(a)(i)	 circuit **S** Circuit correct [1] Ammeter polarity correct [1]	**2**	Must be connected in series.
11(a)(ii)	 circuit **T** Voltmeter connected in parallel [1] Voltmeter polarity correct [1]	**2**	Must be connected in parallel.
11(b)(i)	Tool **A** - wire strippers, used for stripping the insulation from a wire [1] Tool **B** – diagonal cutters, accept cutters, for cutting wires to length [1] Tool **C** – long nose pliers, used for bending wires or component legs or placing /removing components in a circuit [1]	**3**	

Question	Answer	Marks	Guidance
11(b)(ii)	The purpose of flux in solder is: • To keep the joint clean / prevent oxidation • 'Wet' the joint allowing solder to flow • Active fluxes will clean the joint. [2 × 1]	**2**	Allow marks for understanding shown.
11(b)(iii)	Recognised method, e.g. plug and socket, prototype board connection, screw connection, crocodile clips, battery connectors. [2 × 2]	**4**	For each method 1 mark for recognisable sketch, 1 mark for valid method Allow other valid methods. Do not allow twisted wires
11(c)(i)	Capacitors **X** and **Y** are polarised [1] and will need inserting into a circuit the correct way around. [1] It is unsafe to connect them incorrectly [1]. [2 × 1]	**2**	
11(c)(ii)	If capacitors are connected in parallel the total capacitance will be the sum of the values [1]	**1**	
11(d)(i)	The output of the circuit will be a regular [1], astable signal [1]	**2**	Award marks for understanding shown
11(d)(ii)	Correct resistor values used R_1 = 4.7 kΩ, R_2 = 12 kΩ [1] Correct substitution into formula: T = 0.693(4700 + 24000) × 22 / 1 000 000 or ($2.2 \times 10^{-5)}$ or 0.000022 [1] Correct answer 0.438 s or 438 mS [1]	**3**	Award full marks for correct answer with no working.

Question	Answer	Marks	Guidance
11(d)(iii)		**4**	Transistor base and emitter correct [1] Relay coil to collector [1] Collector to diode +ve and diode negative to +9 V (both connections) [1] Signal lamp (both connections) [1]