

Cambridge IGCSE™

DESIGN AND TECHNOLOGY**0445/42**

Paper 4 Systems and Control

May/June 2026

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **15** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions 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 standardisation 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.

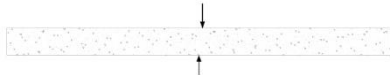
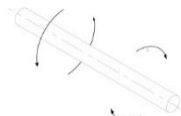
We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of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

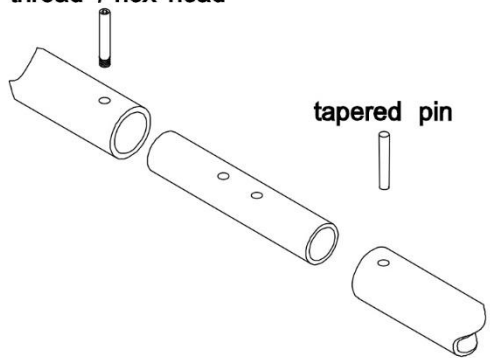
Annotation	Meaning
	Correct point
	Too vague
	Relevant detail

Question	Answer	Marks	Guidance
Section A			
1	The two renewable energy forms are geothermal [1] and tidal [1].	2	
2(a)	The purpose of the push sticks is: - To hold the work securely in position [1] - To ensure that hands are kept away from the blade area [1]	2	
2(b)	Any two pieces of recognised type of PPE such as goggles, visor, ear defenders, gloves, lab coat/apron. [2 × 1]	2	Any other valid response
3	Both structures must be man-made. The triangulated frame should include a clear example of triangulation. E.g. pylon, crane jib, scaffolding, roof truss. [1] The shell structure examples include car body, GRP boat hull, balloon. [1]	2	Any other valid response Allow car, cycle wheel, aircraft.
4(a)	Two force arrows should be shown one above and one below the beam. [1] The arrows should be almost in line vertically. [1] 	2	No mark awarded for single arrow.
4(b)	 Two circular arrows should be visible clockwise and anticlockwise. [1] Centred on the axis of the rod. [1]	2	Allow written description.

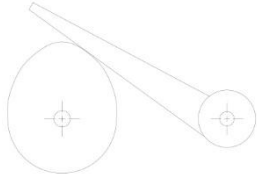
Question	Answer	Marks	Guidance
5(a)	Any two benefits including: • No slipping • Precise position of each gear relative to the others • Long lasting / durable • Control speed • Increase power / torque • Direction of rotation easily changed. [2 × 1]	2	Any other valid response Allow reference to increased mechanical advantage.
5(b)(i)	A – Speed of the driven gear is increased [1] B – Speed of rotation of driven gear is decreased [1]	2	1 mark for each correct.
5(b)(ii)	• The idler gear will pass motion from the driver gear to the driven [1] without affecting the speed [1] • Driven gear rotates in the same direction as the driver [1] • Can be used as a ‘sacrificial’ gear. [1]	2	Any two points needed for 2 marks. Allow two marks for a single point fully described.
6	Relay [1] Light Dependent Resistor or LDR [1]	2	
7(a)	The ammeter is connected in series [1]	1	
7(b)	The unit being measured is amps, ampere, or milliamp [1]	1	Allow ‘A’ or ‘mA’

Question	Answer	Marks	Guidance
8(a)	sub-multiple unit part of 1 farad [2 × 1]	2	1 correct = 1 mark 2 or 3 correct = 2 marks
8(b)	Any one practical advantage [1] Advantages could include: • The reduced size of numbers being used for each value. • Less chance of errors when choosing capacitors • Easier to mark the value onto the component.	1	Any other valid response

Question	Answer	Marks	Guidance
Section B			
9(a)(i)	- Triangles are the strongest form of frame - No reinforcement / strengthening method is needed - The shapes can be tessellated to form the structure. [2 × 1]	2	Any other valid response One mark for each valid point made. Award two marks for a single point fully explained. Allow 'increased rigidity of the structure.'
9(a)(ii)	Reasons for using CAM will include: - Accuracy - Repeatability - Reduction in skilled labour force - Speed of manufacture [2 × 1]	2	Any other valid response
9(a)(iii)	A sustainable resource is one that: - Can be naturally replaced - Provides long term availability - Does not reduce natural resources.	2	Explanation giving two points [2 × 1] marks Allow two marks for a single point fully explained.
9(a)(iv)	Any three benefits [3 × 1] Benefits of having no internal supports will include: - More space inside allowing more flexibility - Reduced amount of materials needed / fewer resources used - Lighter structure - High energy efficiency - Ease of construction and assembly - Benefits for users of structure e.g. aesthetic benefits.	3	Any other valid response
9(b)(i)	The lever is second order or second class [1]	1	

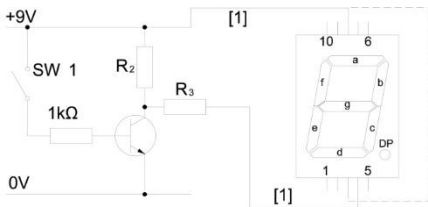
Question	Answer	Marks	Guidance
9(b)(ii)	The following points could be included in explanation: • Longer handles increase mechanical advantage and force applied • Reduced effort is required • The handles have maximum depth of cross section at the point where the nut is being held, which is where maximum pressure will be exerted, this increase strength. • The length is such that it can be comfortably held in a hand • Smooth curved shape allows hand pressure without causing discomfort.	3	1 mark for each valid point, allow 2 marks for full explanation of a single point.
9(b)(iii)	$115 \times 100 \text{ N} = 20 \times \text{Load}$ [1] $11500 / 20 = \text{Load}$ [1] 575 N [1]	3	Award 3 marks for correct answer with no working shown.
9(b)(iv)	• Position A means that the handles will be far apart and difficult to hold • Position C Does not allow enough movement before the jaws are closed • Position B allows easy holding, ergonomically sound and sufficient movement to crack the nut • Points on teeth have reduced cross sectional area = greater force. [2 × 1]	2	One mark for each valid point made, up to 2 marks.
9(c)	thread / hex head  tapered pin	3	Allow any method that does the following: Support provided, e.g. sleeve [1] Outside diameter of tube not increased [1] Can be taken apart [1]

Question	Answer	Marks	Guidance
9(d)	Taking moments about R. $(120 \times 12) + (70 \times 15) = \mathbf{S} \times 27$ [1] Reaction at S = $1440 + 1050 / 27$ [1] Reaction at S = 92.22 kN [1] Reaction at R = $190 - 92.2 = \mathbf{97.77 \text{ kN}}$ [1]	4	Award 4 marks for correct answers with no working.

Question	Answer	Marks	Guidance
10(a)(i)	Cam A has 180° of dwell [1] with a single symmetrical rise and fall [1] Will operate in both directions. [1] Cam B Continuous rise through 360° [1] then a sudden fall [1] Will only operates in one direction.[1] Cam C Two rises for each rotation [1] Each rise is the same distance [1] Will operate in both directions. [1] [3 × 2]	6	Award marks for understanding shown.
10(a)(ii)	Anticlockwise arrow [1] on cam B [1]	2	
10(a)(iii)	 Lever touching cam profile [1] Fixed pivot marked [1]	2	
10(a)(iv)	The output motion is oscillation [1]	1	
10(b)(i)	Bevel gears [1]	1	
10(b)(ii)	Points in explanation could include: • A long crank will apply more leverage to the spindle of gear A • The crank is a class 2 lever • A short crank will have a reduced mechanical advantage.	2	Any other valid response Explanation giving two points [2 × 1] marks Allow two marks for a single point fully explained.
10(b)(iii)	The bevel gears will change the direction of motion through 90° [1]	1	
10(b)(iv)	MA = 21/17 [1] MA = 1.24 or 1.2353 [1]	2	Award 2 marks for correct answer with no evidence of working.

Question	Answer	Marks	Guidance
10(b)(v)	Output speed = Input speed / (Driven teeth / driver teeth) [1] $60 / (21 / 17) = 60 / 1.24$ [1] Output speed = 48.39 rpm [1] Allow 48.57 rpm	3	Allow ecf from (b)(iv)
10(b)(vi)	Any one factor [1] Factors will include: • Friction • Heat • Sound • Vibration.	1	Allow lack of lubrication
10(c)(i)	[3 × 1]	3	1 line correct = 1 mark 2 lines correct = 2 marks 3 or 4 lines correct = 3 marks.
10(c)(ii)	There is no method of fitting a solid bearing onto the journal [1]	1	Award mark for understanding shown.

Question	Answer	Marks	Guidance
11(a)(i)	Benefits of CAD simulated circuit could include: • Speed of assembly / adjustment / editing • No wasted components • Virtual instruments to allow easy testing • Results can be saved and stored. [2 × 1] Benefits of breadboard circuit could include: • Real components used • No computer is needed so low cost • Accurate/realistic results • Components can be reused. [2 × 1]	4	Allow other valid responses for either method. Do not allow 'cheap' for CAD simulated circuit.
11(a)(ii)	Health and safety measures could include: • Protection against chemicals used in process • Protection against UV light used in photo etch process • PPE for drilling • Extraction used to remove fumes • Disposal of waste chemicals.	2	Any other valid response Allow other relevant PPE.
11(a)(iii)	• Test points will provide easy access to specific stages in the circuit • Consistency of testing a batch of boards • Speed of testing on individual boards • Easy isolation of faults.	2	Any other valid response 1 mark for each valid point in explanation [2 × 1] Allow 2 marks for full explanation of a single point.
11(a)(iv)	Any one valid drawback [1] Drawbacks include: • Any fault in design will appear in each board made • Cost of wasted boards • Changes can be made easily to a prototype.	1	

Question	Answer	Marks	Guidance
11(b)(i)	Resistance across pair A using $1/R_{\text{total}} = 1/R_1 + 1/R_2 = \mathbf{3.4\text{ k}\Omega}$ [1] Resistance across pair B = $6.8\text{ k}\Omega + 6.8\text{ k}\Omega = \mathbf{13.6\text{ k}\Omega}$ [1]	2	1 mark for each correct
11(b)(ii)	$V_{\text{out}} = 9 \times 13.6 / 13.6 + 3.4$ [1] $V_{\text{out}} = 9 \times 0.8$ [1] $V_{\text{out}} = \mathbf{7.2\text{ V}}$ [1]	3	Allow ecf from 11(b)(i) Award 3 marks for correct answer with no working.
11(c)(i)	A common cathode display will need a single connection to 0 V with individual segments connected to +ve [1] A common anode display will need a single connection to +ve with individual connections to 0 V [1]	2	Allow marks for understanding shown.
11(c)(ii)	 1 mark for each correct connection	2	Anode can be connected to either pin 3 or 8.
11(c)(iii)	R₂ is a pull up resistor to ensure that the collector connection is at +9V when transistor is off. R₂ will prevent destruction of the transistor when circuit is activated with no load in place. R₃ is a current limiting resistor to control brightness of the display segment.	2	Allow marks for understanding shown.

Question	Answer	Marks	Guidance																																			
11(d)(i)	<table><thead><tr><th>X</th><th>Y</th><th>P</th><th>Q</th><th>red</th><th>amber</th><th>green</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr></tbody></table> [4 × 1]	X	Y	P	Q	red	amber	green	0	0	1	0	1	0	0	0	1	1	0	1	1	0	1	0	0	1	0	0	1	1	1	0	0	0	1	0	4	1 mark for each correct line. Award marks if on = 1 and off = 0
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