

Cambridge National

Engineering Manufacture

R014/01: Principles of engineering manufacture

Level 1/2 Cambridge National Certificate/Award/Diploma

Mark Scheme for June 2025

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.
5. **Crossed-Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award **NR** (No Response):

- if there is nothing written at all in the answer space
- OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
- OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response:

To determine the level – start at the highest level and work down until you reach the level that matches the answer

To determine the mark within the level, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

6. Annotations

Annotation	Meaning
	Blank page
	Seen
	Tick
	Benefit of the doubt (= a mark)
	Level 1 for use on Q14c only
	Level 2 for use on Q14c only
	Level 3 for use on Q14c only
	Highlight Pen tool must be used on Q14c

Applying the annotations

Every page must have a stamp on it to indicate you have checked all the pages that are available. If a page is blank, use the 'seen' stamp.

All question parts must have an annotation applied.

Levels of response questions

- Do **not** use ticks, use the highlighter tool to indicate relevant sections. The number of highlighted sections does **not** equal the number of marks awarded.
- Always stamp the level number at the end of the question, e.g. L2

Do **not** use crosses.

Question			Answer	Mark	Guidance
1			(b) MAG	1	Correct answer only
2			(b) Photochromic pigment	1	Correct answer only
3			(c) The removal of material to create a product	1	Correct answer only
4			(b) Over-processing	1	Correct answer only
5			(a) Countersink	1	Correct answer only
6			(a) Fused deposition modelling	1	Correct answer only
7			(d) Turning	1	Correct answer only
8			(c) Tap and die	1	Correct answer only
9			(a) Alloy	1	Correct answer only
10			(c) DRG	1	Correct answer only

Question			Answer	Mark	Guidance
11	(a)	(i)	Any one from: • Spray/brush painting • Polishing • Ceramic coating • Powder coating Award credit for any other appropriate response.	1	1 mark for any suitable finishing process. Allow “Painting” or “Paint”.
11	(a)	(ii)	Up to four marks for explaining two reasons, e.g.: • To improve resistance against corrosion (1) so they don’t degrade when exposed to the weather (1) • To improve their aesthetic qualities (1) as the bus may need to be finished in a certain colour scheme / so the bus looks visually attractive to users (1) • To remove any scratches/blemishes/marks (1) so that the bus is up to standard for the customer (1) • To increase durability of the finish (ceramic coating) (1) preventing scratches / improved protection against the environment (1) • To apply branding/identity (1) so that the buses are easily recognisable/fulfil advertising requirements (1) Award credit for any other appropriate response.	4	1 mark for each reason up to maximum of 2 marks. 1 mark for explaining each reason given up to a maximum of 2 marks. Allow “looks good/nicer” or “smooth/shiny” as a reason for aesthetics.
11	(b)		Any three from: • To allow problems to be intercepted early • To ensure efficient production • To reduce waste/save money • To improve consistency/reduce errors	3	1 mark for each reason up to a maximum of 3 marks.

Question			Answer	Mark	Guidance
			• To conform to industry standards/regulations • To make sure it is within tolerance • To make sure it is the correct size • To ensure safety in use • To reduce the number of customer returns • To make sure it works Award credit for any other appropriate response.		
11	(c)		Up to two marks for explaining one advantage, e.g.: • Reduced storage space needed/reduced costs associated with storage/inventory management (1) as material needed to make the panels is purchased/received only when needed (1) • Manufacturers do not overproduce products (1) as they are made to order reducing waste/monetary loss (1) • Manufacturers benefit from a no room for error mentality (1) which cuts down on defective/wasted products (1) • Manufacturers do not have large up-front material costs (1) as material is purchased when required (1) Award credit for any other appropriate response.	2	1 mark for any relevant advantage. 1 mark for explaining the advantage.

Question			Answer	Mark	Guidance
12	(a)	(i)	Any one from: • High impact polystyrene/HIPS • High-Density Polyethylene/HDPE • ABS • PEI/Polyetherimide/Ultem • Acrylic/PMMA • PVC • PP/Polypropylene Award credit for any other appropriate response.	1	1 mark for correct answer. Do not award “plastic” or “polymer”
12	(a)	(ii)	Any two from: • Sheet • Granules/pellets • Powder • Film/roll/spool • Custom profiles • Rod/tube/pipe • Resin • Charge/slug Award credit for any other appropriate response.	2	1 mark for each relevant form of supply up to a maximum of 2 marks. Accept any typical forms of supply for the material identified in 12 (a) (i). Marks can be awarded for correct forms of supply for the material identified in 12 (a) (i), even if this material is not appropriate for the application given in the question.
12	(b)		Up to two marks for each explained safety measure e.g.: • Wear heat resistant gloves/appropriate PPE (1) to prevent burn injuries/entanglement (1)	4	1 mark for each relevant safety measure given up to a maximum of 2 marks. 1 mark for explaining why each is necessary up to maximum of 2 marks.

Question			Answer	Mark	Guidance
			• Ensure hair is tied back/loose clothing or jewellery secured (1) to prevent entrapment or entanglement (1) • Emergency stop button (1) so can cut off the power if there is a problem (1) • Ensure the area is well ventilated (1) to prevent build-up of harmful fumes (1) Award credit for any other appropriate response.		Do not award points relating to correct/safe use of the machine i.e.. Don't touch hot parts/keep hands away.
12	(c)		Any three from: • Resistant to high temperatures • Easy/fast to cut/shape • Can be re-used • Shaped to ensure easy release of the formed plastic • Appropriate draft angles • Cost effective material • Smooth surface finish of mould • Air holes • Ability to withstand pressure from vacuum • No fine details/overly complex designs Award credit for any other appropriate response.	3	1 mark for each characteristic up to a maximum of 3 marks. Do not award generic single word terms such as strong/hard/tough/cheap.

Question			Answer	Mark	Guidance
13	(a)		Up to four marks for an evaluation e.g.: • High level of hardness (1) so the cutting edge will not wear quickly/so will successfully cut the softer workpiece (1) • High strength (1) so will resist deformation (1) • High thermal resistance/stability (1) so less likely to overheat (1) • Can withstand effects of friction (1) so less likely to chip/fracture (1) • Corrosion resistant (1) so will not degrade when coolant fluids are used (1) • Good durability (1) to ensure prolonged use (1). • Good chemical resistance (1) to ensure prolonged use with lubricants/cutting fluids/compounds (1) Award credit for any other appropriate response.	4	1 mark for each appropriate point of evaluation/explanation up to a maximum of 4 marks. Do not award “strong”.
13	(b)		Any two from: • Vehicle brakes • Bearings • Heating elements • Electronic/electrical components • Drill bits/drills • Cutting/grinding blade/disc • Lathe tools • Tips of cutting tools Award credit for any other appropriate response.	2	1 mark for each relevant application up to a maximum of 2 marks. Do not allow “cutting tools” as it is stated in previous question unless response specifically refers to the tip of a cutting tool. Allow “saws”.

Question			Answer	Mark	Guidance
13	(c)		Up to four marks for describing the correct steps, e.g.: • Mould production (1) • Wear gloves/masks/safety glasses (1) • Create/grind the powders from appropriate ceramic materials (1) • Mix/blend the powders (1) • Press/consolidate the powder mixture into a mould (1) • Sinter/fire/heat the powder mixture (1) to solidify • Cooling (1) • Sizing/post processing techniques/remove from mould (1) Award credit for any other appropriate response.	4	1 mark for each relevant step described, up to a maximum of 4 marks. Steps do not need to be given in the correct order to gain marks. A maximum of one mark can be awarded for points related to health and safety such as wearing appropriate PPE.

Question			Answer	Mark	Guidance
14	(a)		Up to two marks for an appropriate explanation e.g.: A set of rules/guidelines for how products are manufactured (1) agreed/recognised across multiple nations/countries (1) A set of conditions/requirements for how products are manufactured (1) allowing it to be exported/imported across multiple nations/countries (1). Award credit for any other appropriate response.	2	1 mark for each relevant point/exemplification up to a maximum of 2 marks.
14	(b)		Up to two marks for an explanation, e.g.: Cost of buying is typically reduced (1) because of increased competition/being able to manufacture products abroad at lower cost (1) Countries can set tariffs/tax on imports/exports (1) and as a result products become more expensive (1). Award credit for any other appropriate response.	2	1 mark for each relevant point up to a maximum of 2 marks.

Question			Answer	Mark	Guidance
14	(c)		Level 3 (high) 5-6 marks A thorough discussion. A good understanding with a range of influences being clearly identified and developed. Consistently uses appropriate terminology. The discussion typically includes two or more points recognising both positive and negative influences in relation to employment opportunities Level 2 (mid) 3-4 marks An adequate discussion which shows some understanding, with some influences identified and limited development. Uses some appropriate terminology. The discussion typically includes at least one point relating to positive influences in relation to employment opportunities and may also recognise negative influences. Level 1 (low) 1-2 marks A basic discussion which shows limited/poor understanding. Some influences identified but no development. Little or no use of appropriate terminology.	6	Points of discussion might cover areas such as: • Growth in manufacturing across different countries resulting in additional job opportunities e.g. increasing the number of machine operators for new factories • Increased global competition for skilled manufacturing workers, meaning they have more choice over which jobs they take • Greater choice as to what countries manufacturing workers choose to live and work in • Different wage structures and working conditions depending on which country workers are based in, e.g. workers being paid less in some developing countries than in the UK • Certain jobs moved/offshored from existing local sites to different countries, leading to workers being displaced or losing their jobs entirely • Skill and role requirement changes, resulting in some roles becoming redundant and workers having to retrain or face losing their jobs Award credit for any other appropriate response.

Question			Answer	Mark	Guidance
			The response will typically state an influence with limited discussion/explanation. 0 marks Response is not worthy of credit.		

Question			Answer	Mark	Guidance
15	(a)	(i)	One mark for an appropriate description: The ability of a material to return/revert/go back to its original size/shape after deformation has occurred. Award credit for any other appropriate response.	1	1 mark for correct answer.
15	(a)	(ii)	One mark for an appropriate description: - The ability of a material to be stretched/drawn/rolled without breaking - Ability to be made into a wire Award credit for any other appropriate response.	1	1 mark for correct answer.
15	(a)	(iii)	One mark for an appropriate description: The ability of a material to be shaped/deformed without breaking. Award credit for any other appropriate response.	1	1 mark for correct answer.

Question			Answer	Mark	Guidance
15	(b)		Any three of the following: • Aluminium • Copper • Brass • Bronze • Lead • Tin • Gold • Silver • Platinum • Titanium • Nickel Award credit for any other appropriate response.	3	1 mark each non-ferrous metal up to a maximum of 3 marks. Allow tungsten carbide.
15	(c)		Up to four marks for two applications, e.g.: • Structural beams in bridge/building construction (1) used because cast iron is rigid and will not flex (1) • Engine blocks in motor vehicles/cars (1) used due to cast iron is resistant to wear / can withstand high temperatures (1) • Manhole/drain covers for underground access points (1), used because of the strength of the cast iron can withstand heavy weights of vehicles (1)	4	1 mark for stating each relevant application up to a maximum of 2 marks. 1 mark for explaining why cast iron is used up to a maximum of 2 marks. If the application is unsuitable but the reason can be justified, award 1 mark for explanation.

Question			Answer	Mark	Guidance
			- Frying pan used for cooking (1) used because of its high thermal conductivity / less prone to food sticking / can be used on a variety of heat surfaces (1) - Machinery/machine bases (1) durability/ability to be cast into shape (1) Award credit for any other appropriate response.		

Question			Answer	Mark	Guidance
16	(a)		Up to four marks for describing two products, e.g.: - Bespoke furniture (1) to fit unique spaces (1) - Specialist jewellery (1) for wearing at a special occasion (1) - Racing cars (1) for individual clients/teams/formats (1) - Prototype products (1) to test a design concept (1) Award credit for any other appropriate response.	4	1 mark for each product up to a maximum of 2 marks. 1 mark for describing the one-off aspect of each product up to a maximum of 2 marks. Do not award the second explanation mark if the reason is repeated from the previous example.

Question			Answer	Mark	Guidance
16	(b)		Up to two marks for an explanation of one advantage of using CAM to manufacture products. E.g.: Using CAM will result the ability to accurately manufacture parts/complex parts (1) improving the consistency/quality of products (1) Using CAM can increase the production rate (1) as once the machine is set up, the processes can be automated to repeatedly make products (1) Once programmed/set up, CAM allows automation (1) so the ability to work in hazardous environments (1) Less chance of human error (1) as CAM is more accurate and consistent than humans (1) Can prevent injuries to workers (1) who would have otherwise manually completed dangerous tasks (1) CAM is more time efficient (1) reducing overall manufacture time/cost (1) Manufacturing files can be easily transferred between machines (1) reducing set-up time (1) Award credit for any other appropriate response.	2	1 mark for any relevant advantage. 1 mark for an explanation of the advantage. Do not accept “no human error”.

Question			Answer	Mark	Guidance
16	(c)		Advantages: Up to two marks for explaining one advantage, e.g.: - Improved repeatability/precision/accuracy of manufacture (1) as all products are produced to the same shape/size/dimensions (1) - Reduces time taken to manufacture products (1) as engineers do not need to individually mark out each product (1) - Improved standardisation across the workforce (1) as all engineers use the same template (1) Limitations Up to two marks for explaining one limitation, e.g.: - Limits flexibility of manufacture (1) as some products may need to be made in a different way (1) - An error in the template (1) could result in multiple products being made incorrectly (1) OR costing time/money to remake (1) - Templates can be expensive (1) which increases overall manufacture costs (1) - Staff training required to use (1) which can be expensive/time consuming (1) Award credit for any other appropriate response.	4	1 mark for any relevant advantage. 1 mark for an explanation of the advantage. 1 mark for any relevant limitation. 1 mark for an explanation of the limitation.

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