Cambridge National

Engineering Design

R038/01: Principles of engineering design

Level 1/2 Cambridge National Certificate/Award/Diploma

Mark Scheme for January 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.

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
SEEN	Seen
✔	Tick
REP	Repetition
BOD	Benefit of the doubt
L1	Level 1
L2	Level 2
L3	Level 3

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.

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.

7. **Subject Specific Marking Instructions**

Question			Answer	Mark	Guidance
1			(c) $\emptyset$	1	Correct answer only
2			(b) Textured surface for easy grip (c) Universal size so anyone can use it	1	Award answers (b) and (c) as correct .
3			(d) Injection moulding	1	Correct answer only
4			(b) Carbon fibre patterned finish	1	Correct answer only
5			(b) Chamfer	1	Correct answer only

Question			Answer	Mark	Guidance
6			(c) Land	**1**	Correct answer only
7			(b) Finding out the purpose of components	**1**	Correct answer only
8			(c) Ranking matrices	**1**	Correct answer only
9			(a) 75% of people surveyed prefer Android electronic devices	**1**	Correct answer only
10			(b) Kitemark	**1**	Correct answer only

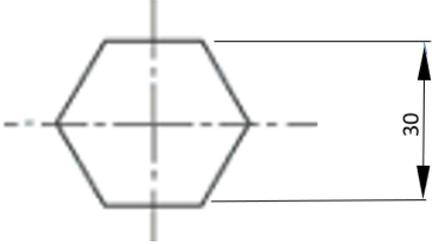| Question			Answer	Mark	Guidance
11	(a)		Correct answers only i.e.: **C**ost (1) **E**nvironment (1) **S**ize (1)	3	Award these answers only. Correct spelling is not required to be awarded marks.
11	(b)		Up to two marks for an explanation e.g.: Designers can interview customers (1) to find out what they want and need (1) Designers can research what is popular and selling (1) to see which functions those products have (1) Designers can analyse existing products (1) to see how competitors' products work (1) Designers could disassemble an existing product (1) to find out features to use in a new design (1) **Award credit for other appropriate responses.**	2	One mark for the way to identify the desired functions. One mark for how that informs the designer / or a justification. Accept answers that refer to primary or secondary research.

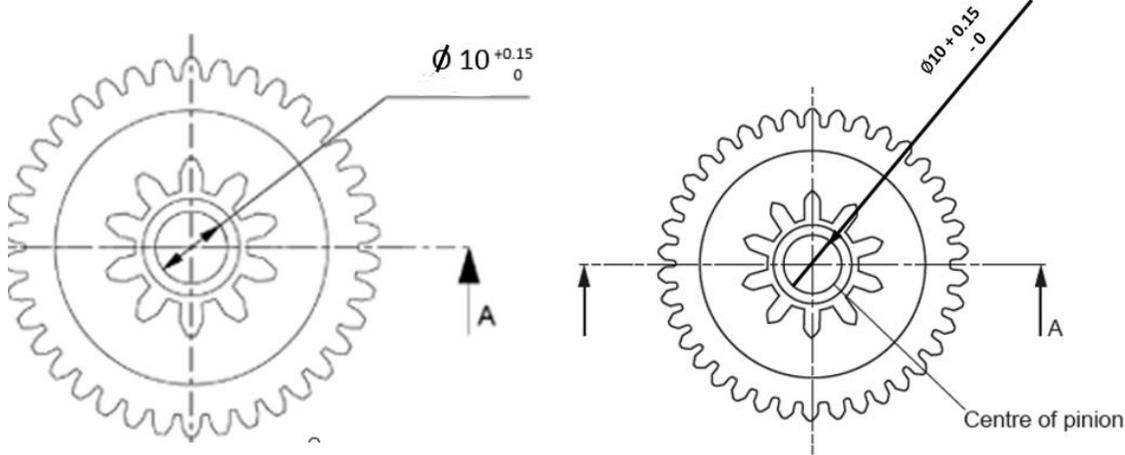| Question			Answer	Mark	Guidance
11	(c)		One mark for each correct factor, e.g.: • Aesthetics (1) • Cost (1) • Customer (1) • Environment (1) • Function (1) • How much work / processing the material will need (1) • Machinability (any form of material processing) (1) • Material availability (1) • Material form / how it is supplied (1) • Properties e.g. durability (1) • Quality (1) • Safety (1) • Scale of production (1) • Sustainability (1) • Texture (1) **Award credit for other appropriate responses.**	2	Do not award 'strong' unless qualified.

Question			Answer	Mark	Guidance
11	(d)		Up to three marks for an explanation with an example, e.g.: Because the designer doesn't want the child to hurt themselves (1) for example, a toy must not be made of a material that is toxic (1) otherwise the child could be poisoned (1) The toy must not be made of a material that will splinter when dropped (1), otherwise the child will get injured (1) and have a negative impact on the reputation of the manufacturer (1) **Award credit for other appropriate responses.**	3	One mark for a product or scenario example. One mark for a reason that material safety is important in this context. One mark for one hazard identified. *OR* One mark for one consequence identified or a justification. *Or* One mark for an additional material safety hazard.
12	(a)		One mark for each correct way e.g.: Some customers may not be able to use the technology for the keypad / touch screen / scales (1) Some customers will not be able to reach the screen /keypad (1) Wheelchair users will find the height / depth of some parts of the checkout impossible to reach (1) Visually impaired may have difficulty using the checkout (1) Some customers may wish to pay with cash (1) Lack of instructions may make it difficult for some user groups to use the self-checkout (1)	2	

Question			Answer	Mark	Guidance
			Award credit for other appropriate responses.		
12	(b)		Up to three marks for an explanation e.g.: One mark for each separate relevant point or explanation: Designers will consult a range of users through interviews (1) to find out which features some users find difficult to use (1) for example, if they want a larger basket shelf (1) Designers carry out trials (1) with users to test features. For example, some users are more comfortable using touch screens than others. (1) Some users like them and find them easy to use (1) Designers would involve users in the design process by asking users / interviewing / using a focus group (1) what features they need or are able to use easily (1). For example, a group of users could be asked if they want a hand-held scanner or just a fixed scanner to make scanning easier (1) Designers could get users to test a prototype self-checkout (1) to see if they can use all of the features / a feature easily / comfortably (1). For example, the if the bagging area bag holders are easy to use or do older users find them difficult to use / reach (1) **Award credit for other appropriate responses.**	3	One mark for method of gathering feedback i.e.: - evaluation of a prototype - focus groups - interviews - surveys - tests / trials One mark for an example identified feature or what is being consulted on / how research is used. One mark for appropriate justification / appropriate reason / impact.

Question			Answer	Mark	Guidance
12	(c)		Up to three marks for an explanation of <u>one</u> way of using anthropometric data e.g.: Anthropometric data such as eye level (1) could be used to determine the height of the keypad / card reader / touch screen (1) so that the majority of users can see these comfortably (1) Data on reach (1) could be used to place the bagging area at a comfortable distance from the scanner (1) so that customers can use the station comfortably (1) **Award credit for other appropriate responses.**	3	One mark for data type or an example of anthropometric data. One mark for an explanation of what the data informs. One mark for extension / justification / impact.
12	(d)		Up to two marks for an explanation e.g.: A full-size card model will allow designers to test the size and proportions of the design (1) to ensure that there is enough space for the customer to carry out their transaction (1) A card model that is full-size will show if features are in the correct place (1) so when you are next to it, you can tell if you can reach it (1) Card modelling is an inexpensive way to make a large model (1) that can be used to check the dimensions are correct (1) Looking at the card model (in person) as a method of primary research (1) to see if it meets the specification points (1) **Award credit for other appropriate responses.**	2	One mark for benefit of a card model. One mark for reason / justification.

Question			Answer	Mark	Guidance
13	(a)	(i)	Marks awarded for each correct aspect as shown. i.e.: • Front elevation drawn to scale [4x4] (1) • 3D shape using the front elevation with lines of sight extending back from front elevation (1) • Oblique drawing using 45º projection lines (1) 	3	
13	(a)	(ii)	• Isometric (1) • Exploded (1) • Freehand (1) • Geometric (1) • Perspective (1) • Sketch (1) • CAD (1)	1	Do not award 'Oblique'.
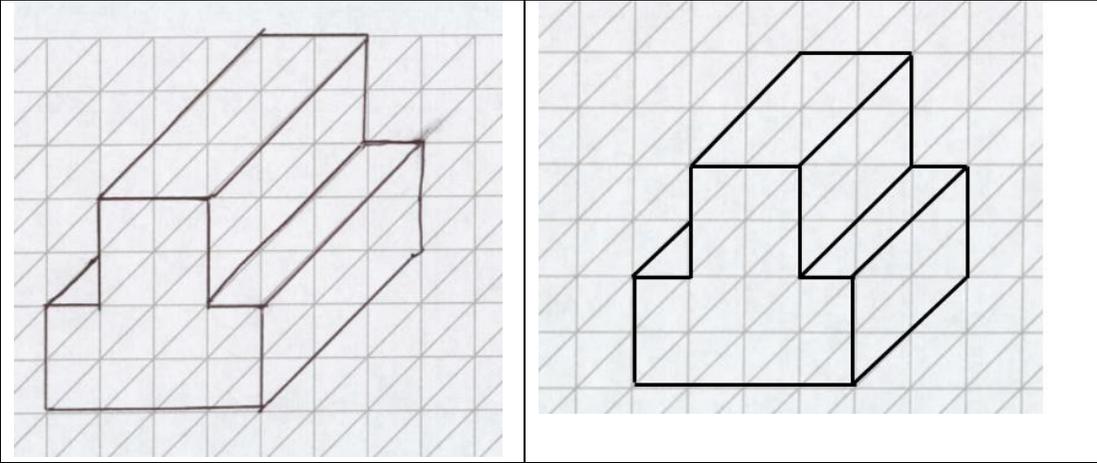
	Question		Answer	Mark	Guidance
13	(b)	(i)	Thread (1)	1	Correct answer only.
13	(b)	(ii)	Correct drawing convention across the flats (1) Any one of the following from: • Leader lines not touching the shape (1) • correct presentation of dimension – value is above the line (1) • the arrowheads should have solid points (1) 	2	

Question	Answer	Mark	Guidance
13 (c)	Up to three marks for a correct application on the conventions i.e.: • Correct convention of the dimension line (1) • correct application of the leader line (1) • representation of tolerance, with a + *or* zero as shown (1) Accept dimension line with leader line without leg as shown in the example on the right.	3	

Question			Answer	Mark	Guidance
14	(a)	(i)	One mark for a valid reason, linked to sustainable design e.g.: The buyer / school may prefer to buy chairs made from sustainable material sources (1) The school may want to be seen as purchasing responsibly, avoiding products that use fossil fuels where possible (1) Some schools may only purchase polymer chairs made from plant-based / bio plastics (1) Schools may not purchase them for environmental reasons (1) **Award credit for other appropriate responses.**	1	
14	(a)	(ii)	E.g.: A focus group could be used (1) to discuss how customers feel about sustainability (1) and to find out if consumers are willing to pay more for sustainable products (1) Questionnaires / surveys / market research (1) could be used to find out the importance of sustainability compared to other factors. (1) This can be used in the design with those preferences included (1) **Award credit for other appropriate responses.**	3	One mark for identifying a relevant way / method or scenario. One mark for explaining how the relevant way / method or scenario is used by the designer. One mark for a link to sustainable design or a justification.

Question			Answer	Mark	Guidance
14	(b)		**Level 3 (5–6 marks)** A **thorough** discussion of the importance of aesthetics when designing a classroom chairs, showing understanding of all the points stated. **Consistent** use of appropriate terminology. Typically, two or more points for both limitations and advantages. Limitations and advantage fully discussed. **Level 2 (3–4 marks)** An **adequate** discussion with some discussion of the importance of aesthetics when designing a classroom chair, showing understanding of **some** of the points stated. **Some** use of appropriate terminology. One or two points made with advantages AND limitations discussed. **Level 1 (1–2 marks)** A **brief** discussion stating only that the appearance needs to look attractive to the user, showing **limited** understanding. **Little** or no use of appropriate terminology. Typically, only one point covered. Answers only cover one side of the discussion (advantages OR limitations). 0 = a response that is irrelevant and/or not worthy of a mark. Annotate with 'Seen' at end of response.	6	Up to six marks for a discussion or detailed explanation with examples, of how far aesthetics are important when designing a classroom chairs. Responses may include reference to: • It is important to schools to attract students and therefore attractive classroom settings may be important when considering aesthetics of the chairs. • Fabric covered chairs and wood grain will look nicer than the usual plastic with a metal frame. • Design features such as the chair arms, height of the back and a unique shape may be important but can add to the cost. • Classrooms used for 6th form / Year 12 and 13 students may want to have more of a business feel to them, so attractive classroom furniture can be important. • Designers will want to ensure the appearance is 'on trend' with colours, and textures will be popular with the image of the school, and modern classroom settings. • Designers may look to include iconic styles to ensure the aesthetic appearance stands out from other classroom chairs.

Question			Answer	Mark	Guidance
					• Designers will want to maintain a business-like appearance to attract large organisations and may include the school's colours.
					• If the appearance is not seen to be attractive the product will not sell.
					• The appearance of the design may be / or may not be as important to some customers as the price; however, schools will need to stay within a budget.
					• As the classroom will require many chairs, this will limit the budget, meaning the aesthetics may become less important
					• Larger desks and classroom chairs with an attractive finish may be more appealing, but the size of the classroom chairs will be limited by the number of desks and chairs required, the size of the classrooms and the costs of these.
					• Aesthetics can sometimes come before quality but schools will need chairs that are of high quality that don't get marked or damaged easily, as they will be moved around a lot.
					• The chairs will not keep their aesthetic quality and appearance if the quality of the materials or finish is poor. The quality and aesthetics will need to be balanced to have chairs that look attractive and stay looking nice for many years.

Question			Answer	Mark	Guidance
15	**(a)**	**(i)**	Freehand sketch (1)	**1**	Accept 'freehand' or 'sketch'.
15	**(a)**	**(ii)**	One mark for one valid function, e.g.: • Display screen with graphics for interactive playing (1) • Speaker for sound output (1) • Directional controls to control the movement of characters etc. (1) • Multiple controls for different types of games (1) • On / off / power switch / button / d-pad (1) • Touchscreen (1)	**1**	
15	**(a)**	**(iii)**	Up to two marks for a description, or two different points made e.g.: Designers find a new technological way of making the product (1) that is then used to add a new feature (1) Technological advances are used to create new products / or features / functions (1) so customers will want to buy them (1) Designers find a new way of interacting with the product (1) e.g. touch screens on small handheld games that increases interaction with the player (1) **Award credit for other appropriate responses.**	**2**	One mark for showing understanding of technology push. One mark for influence on product / example of an influence on the game console. Answers do not have to relate to the hand-held games console.

Question			Answer	Mark	Guidance
15	(a)	(iv)	Up to two marks for each answer e.g.: The game console is small enough to fit in the users' hands resting on the palms (1) which allows the fingers to be free to use the buttons / controls (1) The body of the console is smooth and lightweight (1) to allow it to be held comfortably for long periods of time (1) Rounded off corners (1) so that it is easier to hold (1) The on / off switch is at the top (1) so you do not accidently switch it off when playing (1) The size of the console aligns with the majority of hand sizes linking the design to anthropometrics (1) to make it easier to hold (1) **Award credit for other appropriate responses.**	4	For each answer: One mark for the ergonomic consideration (including placement of buttons / switches, shape etc.). One mark for a benefit / justification.
15	(b)		Up to two marks for an explanation e.g.: Products designed to be produced in large volumes will be designed to use processes that are efficient. (1) An example is injection moulding of a casing for a games console (1) The quantity in relation to scale of manufacture or manufacturing processes (1) can reduce or increase set up cost / cost per product (1) **Award credit for other appropriate responses.**	2	One mark for a recognised scale of manufacture or process. One mark for influence or justification. Answers do not have to be linked to the hand-held games console.

Question			Answer	Mark	Guidance
16	(a)	(i)	Primary (research) (1) Focus group (1)	1	Correct answer only.
16	(a)	(ii)	Award up to 4 marks for a valid discussion e.g.: Design A would be chosen because the table shows it includes nearly all of the criteria the research showed it needed (1). Although this product will cost more for the customer, they will be willing to pay more for a product that includes more features / functions they want (1). Design C would not be chosen as it does not include many of the features that the research showed customers want. (1) Design C will not meet the majority of customer needs even though it is likely to cost less than the other designs. (1) **Award credit for other appropriate responses.**	4	Award up to 4 marks for a valid discussion focusing one or more of the designs (A-C) and or the criteria within the given table. Award one mark for each relevant point made.
16	(a)	(iii)	Rethink (1)	1	Correct answer only.

Question			Answer	Mark	Guidance
16	**(a)**	**(iv)**	Up to three marks for an explanation e.g.: Make the design smaller (1) so that it uses fewer materials (1) which requires fewer resources (1) Design the headphones so that they can be repaired (1) so that when one-part breaks, that part can be replaced or fixed (1) and the headphones don't have to be thrown away (1) Make the headphone out of recyclable materials (1) so they do not go into landfill (1) and have less impact on the environment (1) **Award credit for other appropriate responses.**	**3**	One mark for how the design can be changed. One mark for consequence of the change / justification. One mark for link to sustainability or relevant example.
	(b)		(Planned) Obsolescence (1)	**1**	Only correct answer. Spelling is **not** important as long as the word is recognisable.

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