

ENGINEERING MANUFACTURE

Examiners' report

INCLUDED ON THE
KS4 PERFORMANCE TABLES

OCR Level 1/Level 2

Cambridge National in

Engineering Manufacture

J823

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R014 Summer 2025 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from [Teach Cambridge](#).

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R014 series overview

This paper contained two sections of questions covering the principles of engineering manufacture. Section A comprised of ten multiple choice questions relating to manufacturing processes, material properties and drawing conventions in engineering manufacture. Section B comprised of six sets of questions where candidates were required to:

- identify and explain suitable finishing process and quality systems
- demonstrate an understanding of the vacuum forming process
- demonstrate their understanding of the engineering ceramic silicon carbide
- demonstrate their understanding of international standards and globalisation
- identify and apply their understanding of material properties
- demonstrate their understanding of one-off manufacturing.

To do well in this paper candidates needed a fundamental understanding of finishing processes and quality management within manufacturing process, a sound understanding of the vacuum forming process, the application of engineering ceramics, material properties and applications and one-off manufacturing. Candidates also needed to be able to explain what an international standard is in relation to manufacturing and the impact of globalisation.

To do well in extended writing responses, candidates needed to make sure that the points made were justified, for example, when stating positive and negative impacts globalisation has had on employment opportunities within manufacturing, they explained why rather than simply stating the point. Many excellent responses detailed many positive and negative factors with specific examples supporting the points made.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• were able to successfully identify suitable finishing process and explain why they are necessary • demonstrated good knowledge of the vacuum forming process • demonstrated a clear understanding of the application of silicon carbide • were able to appropriately explain and justify their responses when required • demonstrated a good knowledge of the powder metallurgy manufacturing process • showed a good understanding of the positive and negative impacts of globalisation in relation to employment opportunities.	• gave generic responses that did not relate to the context of the question • overlooked the specifics of questions that related directly to the provided stimulus • struggled to identify appropriate finishing processes • struggled to describe manufacturing processes • struggled to identify material properties and suitable applications for the materials provided.

Section A overview

Section A contained ten multiple choice questions requiring candidates to identify one correct answer for each question.

Question 1

1 Which of these is a type of welding process?

- (a) CAD
- (b) MAG
- (c) PLA
- (d) QTC

☐
☐
☐
☐

[1]

The vast majority of candidates correctly identified 'MAG'.

Question 2

2 Which of these is a smart material?

- (a) Epoxy resin
- (b) Photochromic pigment
- (c) Stainless steel
- (d) Tungsten carbide

☐
☐
☐
☐

[1]

The majority of candidates correctly identified 'Photochromic pigment'.

Question 3

3 Which of these describes a wasting manufacturing process?

- (a) The addition of material to create a product
- (b) The joining of two materials together to produce a product
- (c) The removal of material to create a product
- (d) The use of casting to produce a product

☐
☐
☐
☐

[1]

The vast majority of candidates correctly identified 'the removal of material to create a product'.

Question 4

4 Which category of **lean waste** means to add more components than the customer wants?

- (a) Movement
- (b) Over-processing
- (c) Over-production
- (d) Waiting

☐
☐
☐
☐

[1]

This question drew a range of responses with candidates often split between 'Over-processing' (correct) and 'Over-production'.

Question 5

5 What does this symbol represent on an engineering drawing?



- (a) Countersink
- (b) Knurl
- (c) Thread
- (d) Tolerance

☐
☐
☐
☐

[1]

While most candidates were able to correctly identify 'Countersink' as the correct response, a large number often selected 'Knurl'.

Question 6

6 Which of these is an additive manufacturing method?

- (a) Fused deposition modelling
- (b) Injection moulding
- (c) Press forming
- (d) Strip heating

☐
☐
☐
☐

[1]

While the majority of candidates were able to correctly identify 'Fused deposition modelling' as the correct response, a large number often selected 'Injection moulding'.

Question 7

7 Which of these processes uses a cutting tool to remove material from a rotating workpiece?

- (a) Drilling
- (b) Laser cutting
- (c) Shearing
- (d) Turning

☐
☐
☐
☐

[1]

The majority of candidates were able to correctly identify 'Turning'.

Question 8

8 Which of these items of equipment do you need to create a screw thread?

- (a) Nuts and bolts
- (b) Saw and blade
- (c) Tap and die
- (d) Tin snips and guillotine

☐
☐
☐
☐

[1]

The majority of candidates were able to correctly identify 'Tap and die', however a number of candidates selected 'Nuts and bolts'.

Question 9

9 Which of these material types is a combination of two or more elements, where at least one is a metal?

- (a) Alloy
- (b) Composite
- (c) Thermoplastic
- (d) Thermoset

☐
☐
☐
☐

[1]

While the majority of candidates were able to correctly identify 'Alloy' as the correct response, a large number often selected 'Composite'.

Question 10

10 According to BS 8888, what is the correct abbreviation for **drawing**?

- (a) DGR
- (b) DGW
- (c) DRG
- (d) DRW

☐
☐
☐
☐

[1]

This question drew a range of responses. The correct answer is 'DRG'.

Section B overview

This section has a range of questions styles that generally fall into the following categories:

Identify or state a specific piece of information, image or reason for 1 mark. For these questions, candidates need to be able to demonstrate their knowledge by identifying or recognising a given item within a diagram/image, or use direct recall to answer a question, for example the properties of a material.

Describe, explain, evaluate and discuss questions test candidates' understanding in greater depth than identification or recall style. Understanding will be demonstrated through answering how, why; reasons for, advantages, considerations of something to/in different contexts. For example:

- Describe how something might occur or describe how a particular circumstance will be affected or impacted by a situation for 2-3 marks. Examples are often sought in these questions with a mark being given for an appropriate example.
- Analyse an approach or explain the advantages of a manufacturing scenario or material application for 3-4 marks.
- Discuss: candidates would be expected to approach from more than one point of view. A higher tariff question, with up to 6 marks available and marked via the level of response given within the mark scheme. Candidates should provide more than just a series of statements and be able to expand on these with reasoning, the impact of and or justification. Higher marks are given for answers that include a reasoned discussion/debate with appropriate use of terminology.

Question 11 (a) (i)

11 A manufacturing company makes metal exterior body panels for buses.

(a)

(i) Identify **one** process that would be suitable for finishing the bus body panels.

.....
..... [1]

Candidates generally responded well to this question. 'Painting' was the most common answer.

Question 11 (a) (ii)

(ii) Explain **two** reasons why finishing processes are necessary when manufacturing the bus body panels.

- 1
-
-
-
- 2
-
-
-

[4]

This question was generally answered well and a clear understanding of why finishing processes are necessary was often clearly shown. Those candidates who performed less well often simply stated a reason without explanation.

Question 11 (b)

(b) State **three** reasons why a quality system should be implemented for the bus body panels.

- 1
-
- 2
-
- 3
-

[3]

Candidates responded well to this question, often gaining at least 2 of the 3 marks available.

Question 11 (c)

(c) The bus body panels will be manufactured using a just in time (JIT) approach.

Explain **one** advantage of using a just in time (JIT) approach to manufacture the bus body panels.

.....

.....

.....

..... [2]

This question was generally answered well. The most common correct answers referenced 'less storage required' and 'parts ordered when required' - candidates were generally able to provide a relevant supporting explanation.

Question 12 (a) (i)

12 You are vacuum forming the hard hat shown below.



- (a)
- (i) Identify **one** specific polymer material that would be suitable for producing the vacuum-formed hard hat.

..... [1]

This question was generally answered well and a range of suitable polymers were identified.

Question 12 (a) (ii)

(ii) State **two** typical forms of supply of the material identified in part (a)(i).

1

.....

2

.....

[2]

Candidates generally responded well to this question, often identifying forms of supply such as 'sheets' and 'granules'.

Misconception



When candidates provided incorrect responses for this question it was often due to responses relating to other products or materials being identified. It is important that students understand the term 'form of supply' to access this key area of the specification.

Question 12 (b)

(b) Identify **two** safety measures that should be taken when vacuum forming the hard hat. For **each**, explain why it is necessary.

Safety measure 1

.....

Why it is necessary

.....

Safety measure 2

.....

Why it is necessary

.....

[4]

Candidates generally responded well to this question, often gaining at least 2 of the 4 marks available. There were several responses that related to safe working practices rather than measures put in place such as appropriate PPE, emergency stop buttons and appropriate ventilation.

Question 12 (c)

(c) State **three** characteristics of a suitable mould for producing the vacuum-formed hard hat.

- 1
- 2
- 3
- [3]

A significant number of single word generic terms were stated for this question.

It is important for candidates link their responses to the question to access the full range of marks available.

Question 13 (a)

13

(a) This cutting tool for a milling machine is made from silicon carbide.



Evaluate how the **properties** of this material make it suitable for this application.

-
-
-
-
-
- [4]

Candidates often gained at least 2 of the 4 marks available. Those responses that were not awarded credit often gave generic terms that were not qualified such as 'strong' rather than relating to the specific properties of silicon carbide that make it suitable for this application.

Question 13 (b)

(b) State **two other** common applications of silicon carbide.

- 1
- 2
- [2]

Candidates generally responded well to this question with a range of other appropriate application of silicon carbide provided. Those candidates who performed less well often repeated 'cutting tools' from the stem of the question.

Question 13 (c)

(c) Silicon carbide is an example of an engineering ceramic.

Describe **four** steps required to produce a ceramic part using powder metallurgy.

- 1
- 2
- 3
- 4
- [4]

Candidates often struggled to identify four steps required to produce a ceramic part using powder metallurgy. Responses often referred to the use of a mould and application of heat but rarely was this directly related to the powder metallurgy process.

Assessment for learning



It is important that students cover the full range of the specification as part of their learning journey. The powder metallurgy process is identified in the specification document under Topic Area 1.2.2.

Question 14 (a)

14

(a) Describe what an **international standard** is in relation to manufacturing.

.....

.....

.....

..... [2]

This question was generally answered well. The most common correct answers referenced 'drawing standards' and 'agreed/recognised in multiple countries' - candidates were generally able to provide a relevant supporting explanation.

Question 14 (b)

(b) Explain how globalisation has impacted the cost of buying manufactured products.

.....

.....

.....

..... [2]

This question was generally answered well. The most common correct answers referenced 'lower costs due to lower labour costs' or 'increased costs due to tariffs/import tax' - candidates were generally able to provide a relevant supporting explanation.

Question 14 (c)

(c) Discuss how globalisation has influenced employment opportunities within manufacturing.

.....

.....

.....

.....

.....

..... [6]

Level 3 responses were able to clearly identify several different positive and negative factors regarding employment opportunities in relation to globalisation. Typically, these responses presented two or more points for both positives and negatives while demonstrating a clear understanding of the term globalisation.

Level 2 responses tended to give both positive and negative impacts but did not offer sufficient explanation as to the relationship of these to globalisation.

Level 1 responses often either focussed solely on positives or negatives regarding the impact of globalisation on employment opportunities and often lacked supporting explanation.

Exemplar 1

Globalisation has meant that in lower income countries, there are more employment opportunities in manufacturing that even lower educated people ~~to~~ can apply for. ~~However this is~~ Due to the need of more workers, ^{more} women as well as men are being hired. However some jobs that require high skilled workers won't be as available & since they required better skilled people with education. In high income countries ~~for~~ since companies mostly outsource to cheaper to manufacture countries, this has caused deindustrialisation and many workers have lost jobs ~~and~~ ~~only~~ in manufacturing. However in poorer countries, this has meant long and dangerous working conditions with low pay and there has been child labour involved. [6]

Exemplar 1 shows an extract from a Level 3 response where the candidate clearly identifies numerous positive and negative impacts of globalisation in relation to employment opportunities. Each point is supported by an explanation and appropriate terminology.

Question 15 (a) (i) (ii) and (iii)

15

(a) Describe what each of these material properties mean:

(i) Elasticity

.....
..... [1]

(ii) Ductility

.....
..... [1]

(iii) Malleability

.....
..... [1]

Responses were often varied for these questions. Candidates were mostly able to correctly state 'the ability for a material to return to its original shape' for part (i) and 'the ability to be stretched/drawn' for part (ii) however a significant number of candidates did not provide an appropriate response for part (iii).

Question 15 (b)

(b) State **three** types of non-ferrous metals.

1
2
3 [3]

This question was generally answered very well with the majority of candidates correctly identifying three non-ferrous metals.

Question 15 (c)

- (c) State **two** applications of cast iron. For **each** application, explain a different reason why this material is used.

Application 1

Why cast iron is used

.....

.....

Application 2

Why cast iron is used

.....

.....

[4]

Candidates responded well to this question, often gaining at least 2 of the 4 marks available. 'Pots/pans' were the most popular applications with 'thermal conductivity' often referred to as the reason.

Question 16 (a)

16

- (a) Describe **two** products that would typically be made using one-off manufacture.

An example is given for you:

Example: A 3D printed joystick, made to fit a prototype games controller.

1

.....

.....

.....

2

.....

.....

.....

[4]

Candidates responded well to this question, often gaining at least 2 of the 4 marks available.

Question 16 (b)

(b) Explain **one** advantage of using CAM to manufacture products.

.....

.....

.....

.....

[2]

This question was generally answered very well with most candidates correctly identifying an advantage of using CAM to manufacture products.

Question 16 (c)

(c) Explain **one** advantage and **one** limitation of using templates to manufacture products.

Advantage

.....

.....

.....

Limitation

.....

.....

.....

[4]

Most candidates provided appropriate responses to this question. Occasionally candidates would not explain their advantage or disadvantage but on the whole appropriate points were made and supported.

'Explain' questions

When considering their response to an explain question, candidates should be encouraged to support the point they are making with a relevant example or justification in order to access the full range of marks available.

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