OCR
Oxford Cambridge and RSA

CAMBRIDGE NATIONALS

Examiners' report

ENGINEERING MANUFACTURE

Cambridge NATIONALS

J832, J842

R109 Summer 2018 series

Version 1

Contents

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. 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 can be downloaded from OCR.

Paper R109 series overview

This paper covers Levels 1 and 2 of both the Cambridge National Award and the Cambridge National Certificate in Engineering Manufacture. The content of the paper includes questions relating to all four learning outcomes in the specification.

To do well on the paper, candidates needed to have sound knowledge and understanding of engineering materials and processes, and their application in engineering manufacture. They should also have been able to demonstrate knowledge of developments in engineering processes, and how modern technologies have been applied in engineering production.

Candidates who did well on this paper generally did the following:

- gave responses that directly addressed the focus of the questions
- demonstrated sound knowledge of a wide range of engineering materials
- gave fully detailed and justified responses to questions asking for descriptions and/or explanations
- demonstrated good knowledge of a range of engineering processes and modern developments in them
- demonstrated good quality of communication in the extended response question.

Candidates who did less well on this paper generally did the following:

- gave no response to a number of questions on the paper
- occasionally gave irrelevant responses through not addressing the true focus of questions
- showed confusion between types of engineering materials
- demonstrated very limited knowledge of engineering processes
- gave overly simplistic answers to questions asking for descriptions and/or explanations
- demonstrated little quality of written communication in the extended response question.

Most candidates attempted all of the questions on the paper although in some cases a lack of response to questions indicated candidates' limited knowledge of parts of the specification. There was also some evidence that candidates had not read questions carefully enough before answering. It is most important that candidates take the time to read through the question paper before attempting to answer questions. Marks can easily be lost simply by not answering the question as it was asked.

Responses to questions relating to engineering processes indicated an area where some improvement is needed. This was particularly so with regard to questions dealing with processes widely used in engineering manufacture.

Where candidates are asked to describe or explain processes or procedures, it should be noted that well justified responses are needed. One-word or overly simplistic answers are not suitable responses to this type of question. In many cases candidates were credited only a single mark out of three available on such questions.

Question 1 (a) (i)

1 Many different materials are used in the manufacture of engineered products.

(a) (i) Give **three** examples of non-ferrous metals.

1 .....

2 .....

3 .....

[3]

Most candidates scored well on this question although, in a number of cases, there appeared to be some confusion between ferrous and non-ferrous metals. Where marks were lost, this was generally as a result of including one or more ferrous metals in the examples given. Some candidates of lower ability demonstrated limited knowledge of engineering materials by giving examples of entirely different material types. In many cases, thermoplastics were named as examples, and smart materials also appeared occasionally.

Question 1 (a) (ii)

(ii) Describe what is meant by the term 'alloy'.

.....

.....

.....

..... **[2]**

This question was generally well answered, with most candidates giving the simple description 'a mixture of metals'. A number of candidates did lose marks, and this was normally as a result of not making any reference to metal. In a number of cases the question had not been attempted at all.

Question 1 (b) (i)

(b) (i) Describe the main difference between thermoplastics and thermosetting plastics.

.....

.....

.....

..... **[2]**

Only the candidates of higher ability gave descriptions that warranted full marks on this question. A number of candidates stated that thermoplastics could be 'remoulded' and scored one mark only for an appropriate reference to thermosets. Many candidates of lower ability mixed up the two types of plastics and suggested that thermosets could be re-softened whereas thermoplastics could not.

Question 1 (b) (ii)

(ii) Name **three** thermoplastics.

1 .....

2 .....

3 .....

[3]

Few candidates were able to name three thermoplastics, and many scored only one or two marks on this question. Marks were often lost by wrongly giving thermosetting plastics, such as urea-formaldehyde, as an example of a thermoplastic. In some cases other material types were suggested, and examples of alloys and smart materials were quite often seen. A number of the lower ability candidates did not even attempt the question.

Question 2 (a)

2 **(a)** Complete the table below by giving **one** typical use for each of the materials given.

One has been done for you.

Material	Typical use
Tungsten carbide	Cutting tool tips
Stainless steel	
Carbon fibre	
Cast iron	

[3]

Responses to this question were mixed and only a limited number of candidates were able to give appropriate examples of use for all three of the materials given. Typical uses of stainless steel were generally well covered, with cutlery being by far the most popular example. Some appropriate uses of cast iron were also seen, machine bases and vices being quite common. Candidates were obviously aware of the useful properties of carbon fibre but, when it came to typical uses, the examples given were often too vague to warrant a mark. 'Car parts' and 'formula one cars' appeared in many responses.

Question 2 (b)

(b) Explain why sustainability is an important characteristic of engineering materials.

.....

.....

.....

..... **[2]**

This question was not well answered generally. Many candidates approached the issue of sustainability from the point of view of a product rather than materials, while some simply made references to availability. Only the candidates of higher ability gained full marks by considering the problems of raw material depletion and increasing material usage.

Question 2 (c)

(c) Three types of smart materials are listed below.

Shape memory alloy (SMA)
Thermochromic materials
Quantum tunnelling composite (QTC)

Choose **one** type of smart material from the list and describe its use in a product.

.....

.....

.....

.....

.....

..... **[3]**

Although most candidates attempted this question, few gained more than one or two marks on it. The two most frequently chosen smart materials were thermochromic materials and shape memory alloy (SMA). Of these, thermochromic material was the one that elicited the more detailed and accurate descriptions. The most common reason for loss of marks on this question was the lack of reference to a product in the response. Descriptions of a use of shape memory alloy were also rather vague in many cases. Some higher ability candidates chose to describe the use of quantum tunnelling composite (QTC) and presented clear and justified answers.

Question 2 (d)

(d) Describe **one** simple workshop test that could be used to test the hardness of a metal.

.....

.....

.....

..... **[2]**

Responses to this question were very mixed and some candidates did not even attempt to answer it. The question asked for a description of a 'simple workshop test' for the hardness of a metal. Although most of the tests described were simple, very few could be accepted as effective, and only a small number of candidates scored any marks on the question. Where candidates had identified a recognised test, such as Vickers, Brinell or Rockwell, rather than describing a simple workshop test, one mark was given. In a number of cases candidates had confused hardness with toughness and described an impact test.

Question 3 (a)

3 Fig. 1 shows an aluminium alloy angle section made by the extrusion process.

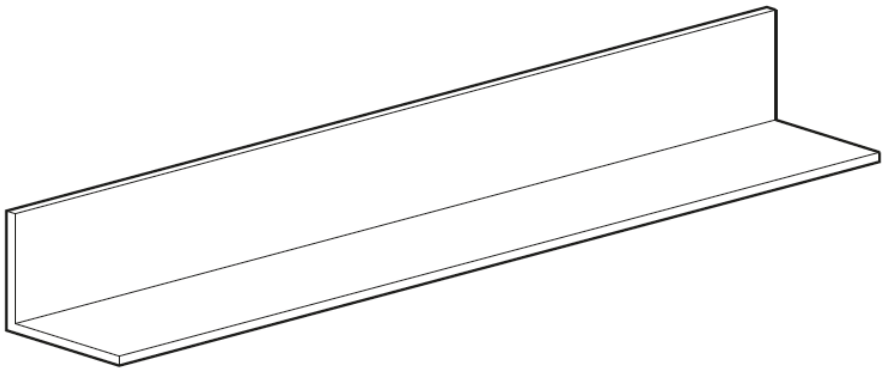


Fig. 1

(a) Describe how the extrusion process would be used to produce the aluminium alloy angle section.

.....

.....

.....

.....

.....

..... **[3]**

Question 3 (b) (i)

(b) Extrusion is a forming process.

(i) Name **two** other forming processes for metal.

1 .....

2 .....

[2]

It was clear from responses to these two questions that knowledge of forming processes for metal was generally quite limited. This was particularly so in the case of extrusion, and only the higher achieving candidates gave descriptions of the process that were at all valid. Most of the responses to part (a) related to forming the angle section by bending sheet aluminium alloy. Others gave very limited descriptions of what appeared to be a casting process. A significant number of candidates did not attempt to answer this part of the question, further indicating a shortage of knowledge in this area of the specification.

Most candidates were able to name at least one other forming process in part (b)(i) of the question. Often, however, the process or processes given related to the moulding of plastics rather than metal forming. Of the valid examples presented, forging was the most frequently seen, and the higher achieving candidates were able to score full marks on the question by also including a casting process.

Question 3 (b) (ii)

(ii) Describe **two** benefits of using forming processes in engineering production.

1 .....

.....

.....

.....

2 .....

.....

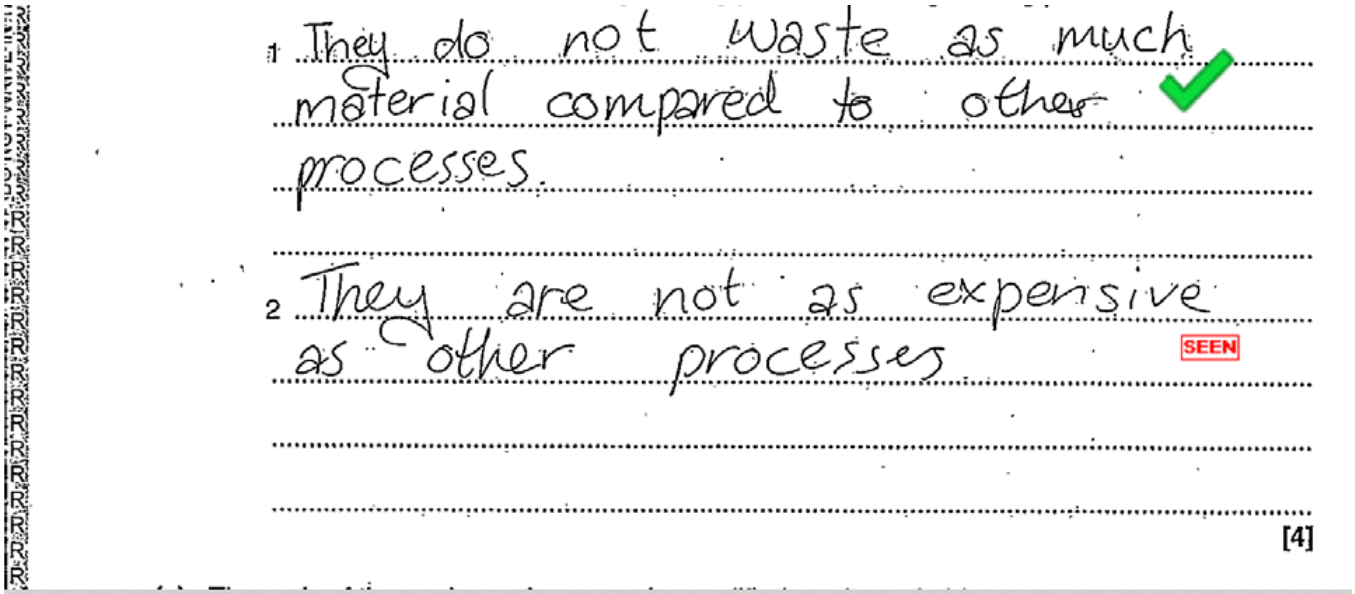
.....

.....

[4]

Responses to this question were very mixed and only the more able candidates scored three marks or more on it. Benefits given by the lower ability candidates were generally too simplistic, and a significant percentage of the total candidature scored only one mark or even less on the question.

Exemplar 1



Response 1 needs justification to qualify for the second mark. Response 2 lacks qualification

In this case, the candidate has given one relevant benefit of using forming processes but has not described how the reduction in material waste is made possible. The second response is far too simplistic for this type of question as it makes no comparison with other processes, or takes into account set-up costs prior to using the process.

Exemplar 2

1 No weakpoints due to there being no joins, as the ~~piece~~ product would've been made from one ~~an~~ piece of ~~metal~~ metal.

2 You can create much more complex shapes from one piece, rather than having to use multiple pieces to create one part.

[4]

Both responses appropriate and justified - full marks awarded

Although these two descriptions of benefits are not particularly well worded, they contain sufficient content to earn the candidate full marks on the question. Both benefits are valid and well-reasoned. The first one states why there would be no weak points, and the second how the complex shape would need to be produced by other means.

Question 3 (c)

(c) The ends of the angle section are to be modified as shown in Fig. 2.

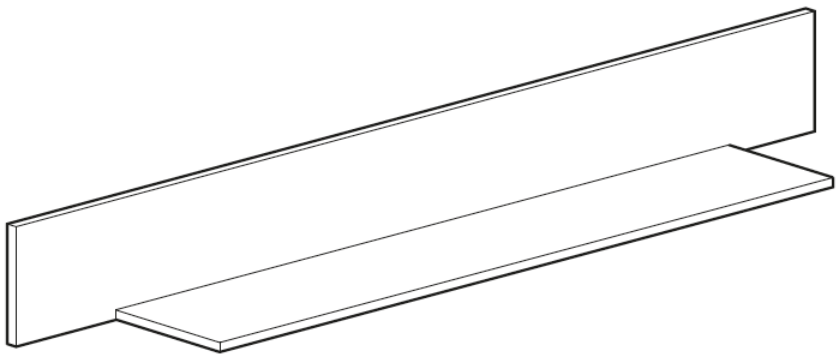


Fig. 2

Give **one** process that could be used to modify the ends of the angle section.

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

Most candidates attempted this question and a wide range of different answers were seen. The most frequently seen correct responses were milling and laser cutting. Some candidates of lower ability named a tool rather than a process, hacksaws being the most common. In a number of cases, the suggested processes were entirely inappropriate for the task, with filing and grinding being typical examples of this.

Question 4 (a) (i)

4 Heat treatment processes are used to modify the properties of engineering materials.

(ii) Name **three** other heat treatment processes.

1 .....

2 .....

3 .....

[3]

.....

..... **[2]**

Question 4 (a) (ii)

Responses to these two questions indicated that heat treatment of metals is a section of the specification that is not well understood by many candidates.

In part (i) the question about the process used to soften brass before bending was not well answered generally and only the higher achieving candidates scored two marks or more. Marks were given for naming the process and for referencing the stages of heating to red hot and cooling slowly. The process was only seen correctly named as 'Annealing' in a limited number of responses, and reference to heating was often too vague to warrant a mark. The majority of candidates scored no marks at all on this question and again a significant number of candidates did not even attempt an answer.

In part (ii), candidates were required to name three other heat treatment processes, and this question was quite well answered by many candidates. Most candidates were able to correctly name at least two processes, and almost half of the entire cohort scored full marks on the question. Where marks were lost by the lower ability candidates, this was normally as a result of giving the names of other processes that involved heat, such as forging and welding.

Question 4 (a) (iii)

(iii) Give **three** safety precautions needed when carrying out heat treatment processes.

1 .....

2 .....

3 .....

[3]

Most candidates scored well on this question, many earning full marks by giving three safety precautions that were fully relevant to processes involving the use of heat. Where marks were lost, this was invariably by making simple statements such as 'wear PPE'. When making reference to PPE, candidates needed to provide specific examples, such as leather gloves and leather aprons.

Question 4 (b)

(b) Name **one** surface finishing process suitable for use on brass.

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

This is a question where it was particularly important for candidates to read the question carefully before answering. It should be noted that the question asked for a finishing process that is *suitable* for use on brass, not one that *could* be used. In a number of cases suitable processes such as polishing and electroplating were seen, but painting was given by many candidates, and was not accepted as being suitable.

Question 5 (a)

5 Water jet cutting is carried out on Computer Numerical Control (CNC) machines.

(a) Describe **two** benefits of using water jet cutting in engineering production.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

Most candidates attempted this question, although only those of higher ability scored full marks on it. In many cases the benefits mentioned in responses were not specifically related to water jet cutting, but could be applied to any CNC machining operation. Much reference to 24/7 working; accuracy due to computer control; and lack of human error was made, but comparisons to other processes were seldom seen. The most frequently seen appropriate and justified response was based around the water used in the process, candidates noting that it produced a clean cut and washed away the metal removed.

Question 5 (b)

(b) Give **two** applications of lasers in engineering production.

1 .....

2 .....

[2]

It was encouraging to see that many candidates are quite knowledgeable on this aspect of modern technology, and this question was generally well answered. Most candidates were able to give at least one application of lasers in engineering production, with laser cutting, laser welding and laser sintering being the most popular answers. Some of the higher achieving candidates also made clear reference to the use of lasers in quality control and in rapid prototyping (SLA).

Question 5 (c)

(c) Introducing modern technologies into engineering production has resulted in a loss of jobs for some workers.

Describe **two** other effects on the workforce of introducing modern technologies into engineering production.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

This question was another example of the importance of reading questions carefully. Although the stem of the question clearly stated that modern technologies in engineering production had resulted in a loss of jobs for some workers, a number of candidates repeated this as one of the effects on the workforce in their responses. Marks gained on this question were generally quite low, and only the candidates of higher ability scored three or more marks by giving justified descriptions of effects that were relevant to the focus of the question. The need for retraining, and improvements in working conditions were factors mentioned in some of the better responses.

Question 6 (a)

6 **(a)*** Discuss the impact of modern technologies on quality in engineering production.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

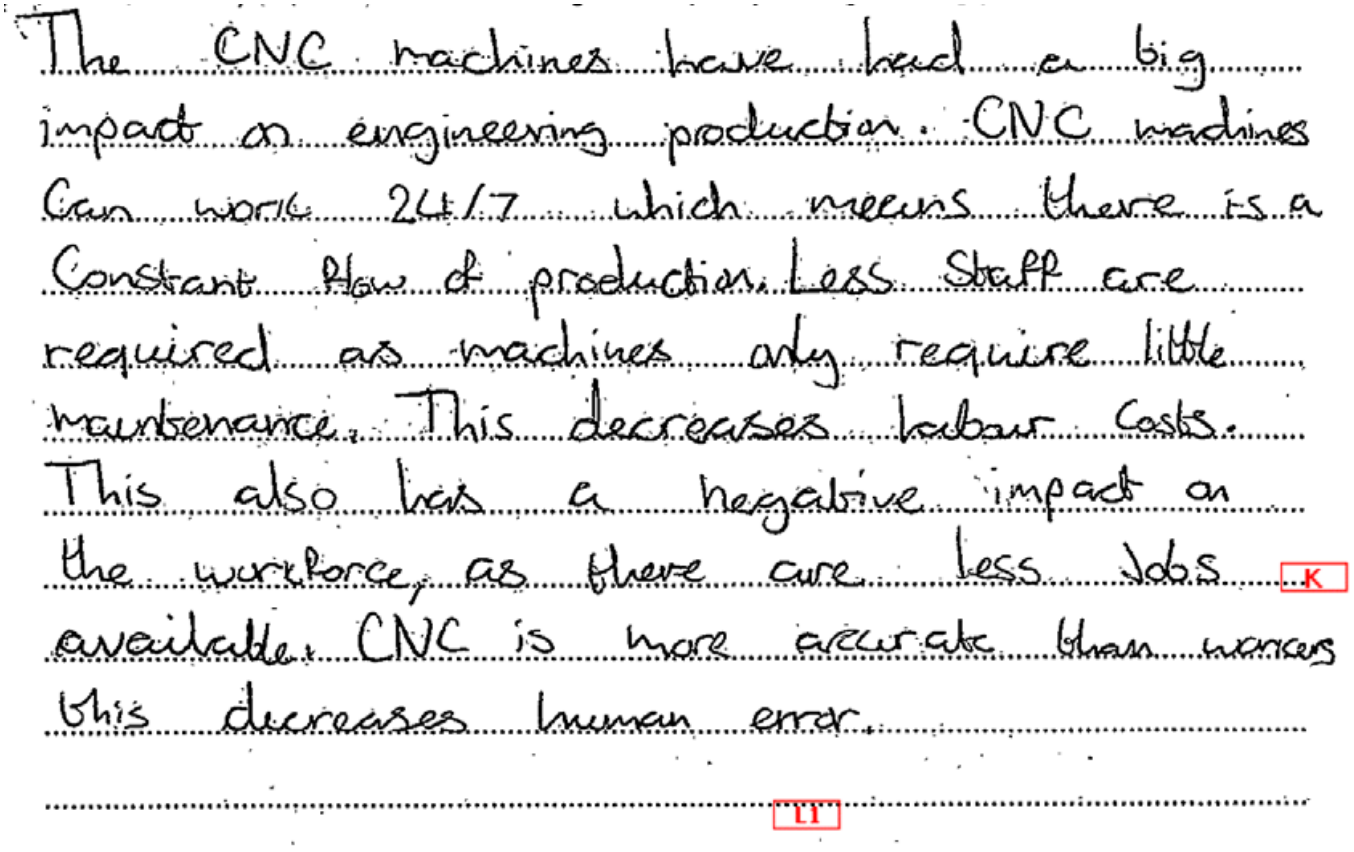
....

....

.... **[6]**

This type of question is used to assess the candidates' quality of written communication (QWC), and requires them to present a detailed and reasoned discussion on the topic that forms the focus of the question.

Exemplar 3

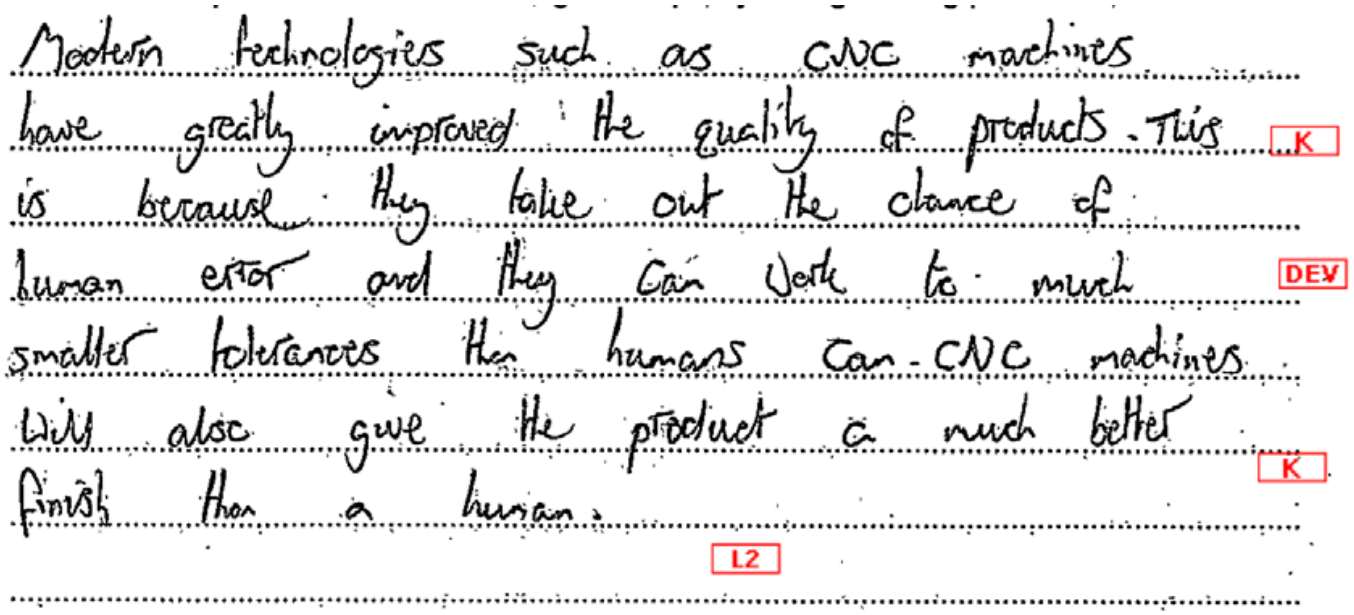

The CNC machines have had a big impact on engineering production. CNC machines can work 24/7 which means there is a constant flow of production. Less staff are required as machines only require little maintenance. This decreases labour costs. This also has a negative impact on the workforce, as there are less jobs available. CNC is more accurate than workers this decreases human error.

K

L1

This response is certainly quite well presented and might also appear to be reasonably well detailed. This candidate has concentrated on more general examples of the impact of modern technology on engineering production, such as increased production and the loss of jobs. Only one very simplistic reference to quality, the focus of the question, appears briefly at the very end of the response. This is a typical Level 1 response, of which many were seen across the overall candidature.

Exemplar 4


Modern technologies such as CNC machines have greatly improved the quality of products. This is because they take out the chance of human error and they can work to much smaller tolerances than humans can. CNC machines will also give the product a much better finish than a human.

K

DEV

K

L2

In comparison to the previous example, this candidate has addressed the focus of the question correctly, making two fully valid points and developing one of them in some detail. Overall the response is relatively brief, although the candidate has produced sufficient content for this to be accepted as a Level 2 response.

Question 6 (b) (i)

(b) Email is one example of digital communication.

(i) Give **two** other examples of digital communication.

1 .....

2 .....

[2]

Question 6 (b) (ii)

(ii) Describe how email might be used in material supply and control.

.....

.....

.....

..... **[2]**

Although most candidates attempted these questions, detailed knowledge of the use of digital communication appeared to be quite limited.

In part (i) many candidates were only able to give one appropriate example of digital communication, with 'telephone' often being given as the second example. Where two appropriate examples were given, texting, video conferencing and social media were frequently seen. Although reference to email appeared in the stem of the question, a small number of candidates included this as one of their examples of digital communication, despite being asked for 'other' examples in the question.

Although candidates were obviously familiar with the use of email, many were unable to provide a suitably justified description in part (ii). Most candidates scored one mark only by giving a simplistic statement regarding sending an email. Only the higher achieving candidates extended their answers to include mention of the fact that orders can be sent instantly. The use of email in the just-in-time manufacturing system was also made reference to in some cases.

Supporting you

For further details of this qualification please visit the subject webpage.

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website. If university places are at stake you may wish to consider priority service 2 reviews of marking which have an earlier deadline to ensure your reviews are processed in time for university applications.

activeresults

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.

It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres
- **Analyse results** at question and/or topic level
- **Compare your centre** with OCR national averages or similar OCR centres.
- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results/

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback directly from a senior assessor or drop in to an online Q&A session.

https://www.cpdhub.ocr.org.uk

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk

OCR Customer Contact Centre

Vocational qualifications
Telephone 02476 851509
Facsimile 02476 851633
Email vocational.qualifications@ocr.org.uk

OCR is part of Cambridge Assessment, a department of the University of Cambridge. *For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.*

Cambridge Assessment

LLOYD'S REGISTER · LRQA
ISO 9001
UKAS MANAGEMENT SYSTEMS
001