OCR
Oxford Cambridge and RSA

CAMBRIDGE NATIONALS

Examiners' report

ENGINEERING MANUFACTURE

J832, J842

R109 Summer 2019 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, mark scheme and specification can be downloaded from the OCR website.

Paper R109 series overview

R109 is an un-tiered, externally examined, mandatory component of J832 and J842, these being the Award and Certificate respectively, in Engineering Manufacture. This component assesses candidates' knowledge and understanding of engineering materials and processes. The paper requires short and extended written answers and includes synoptic assessment and assessment of the quality of written communication.

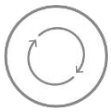
Candidates in general appeared to have been well prepared for this session. Most candidates attempted all questions and there were few instances of no response. Candidates also used their time appropriately and virtually all candidates completed the paper within the allocated time. Many candidates used extra pages/continuation sheets. These extra pages were in nearly all cases clearly and accurately labelled indicating the question that the additional response was referring to.

A number of centres enabled candidates to make use of the Equality Act by using exam access arrangements, most obviously through the use of word-processed answer sheets. In many but not all cases candidates answered on the question paper where it was most suitable to do so and used the word-processed sheets to support their written responses. It would benefit candidates in future sessions if they were well practised in which types of questions are best answered on the paper and which to use word processing for. Some candidates were able to organise their word-processed responses well and produced answer sheets that were very clear and easy to follow which question their response referred to. This was however not always the case and centres could help candidates who answer using a word processor by training them to make good use of line spacing and white space to help candidates to organise their responses so that it is clearer and easier for both the candidate to check their work and the examiner to assess it.

A wide range of marks were gained in this paper. Often it was clear that some candidates had transferred synoptic knowledge and understanding gained practically in the centre assessed units. There were also clear differentials between candidates who had learned subject content from across the whole of the specification relating to R109 and those who had not. It should be borne in mind that direct questions can be asked of any of the unit content that is shown with an "i.e.". The success of candidate responses can be generalised as follows:

Most successful responses	***Least successful responses***
Had detailed knowledge and understanding of engineering manufacture especially with respect to properties and uses of materials. Showed broad knowledge drawn from across the whole of the R109 specification statements. Demonstrated an understanding and familiarity with the different command verbs e.g. identify, describe, explain and discuss. Gave broad and balanced responses that incorporated several points, which were often developed, when answering the longer written answer questions.	Lacked basic knowledge and understanding of materials, for example confusing properties such as malleability and ductility. Found it difficult to apply what they had learned to different scenarios and instead gave answers that were simply a repeat or rewording of what was given in the stem of the question. Lacked specificity with reference to grades of material, for example when writing about steel or iron. Repeated the same point in different ways when answering the longer written responses.

Instances of poor examination technique that were seen included misunderstanding of command verbs or circling more than one answer when the question clearly called for one to be circled.

	**AfL**	Centres can train their candidates to deconstruct questions, paying attention to locating the command verbs, the exact meaning of command verbs and the demand that the command verb requires in the response. The last point for example can be taught explicitly by instead of asking the candidate for the answer to a question, to ask for an example of what the answer would look like. This can be done for a variety of command words with increasing demand e.g. name/state, suggest, describe, explain, evaluate etc., while keeping the remaining stem of the equation the same as far as possible.

Question 1 (a) (i)

1 Complete the following questions on engineering materials.

(a) Fig. 1 shows a range of children's construction bricks.

Fig. 1

(i) Circle the material from the list below which is commonly used to make children's toys such as the construction bricks.

copper **lead** **ABS** **concrete** **epoxy resin** **[1]**

This question was intended to be a straightforward lead into the exam to settle the candidates. So, most candidates were able to correctly identify ABS as a material commonly used to make children's toy bricks. Occasional incorrect candidate responses given were epoxy resin or, more rarely, lead.

Question 1 (a) (ii)

(ii) Give **two** reasons why the material chosen is suitable for the toy construction bricks.

1 .....

.....

2 .....

.....

[2]

There were many marking points acceptable for this question and as a result a very large number of candidates scored highly. Common credit worthy responses included; the relative inexpensiveness of the material; the range of colours available and; non-toxicity. Some candidates' responses did not gain credit because they were too vague, examples including "suitable for children" and "not harmful if swallowed", the bricks of course could be a choking hazard even though ABS is non-toxic.

Question 1 (b) (i)

(b) Fig. 2 shows a brick wall that has been completed using 300 × 300 × 100 decorative wall blocks on the top course.

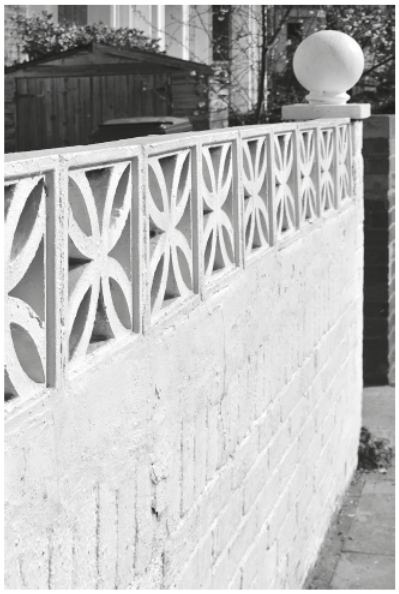


Fig. 2

(i) State the name of the material used to make the wall blocks.

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

A large majority of candidates gained credit with the correct response. Brick and clay were frequent incorrect responses. A few candidates gave cement as an incorrect response possibly indicating confusion between cement and concrete. Very few candidates left the response line blank.

Question 1 (b) (ii)

(ii) Circle the term from the list below which describes the type of material used in the production of the wall blocks.

Ferrous **Non-ferrous** **Ceramic** **Composite** **[1]**

This was another question where most candidates circled the correct response. Nearly all candidates who gave an incorrect response did so by circling ceramic indicating a misunderstanding or gap in candidate knowledge.

Question 1 (b) (iii)

(iii) Give **two** reasons why the material is suitable for the wall blocks.

1 .....

.....

2 .....

.....

[2]

There were many creditworthy marking points for this question and most candidates scored highly. Some candidates did not gain credit with the response "strong" as this was too vague and required qualification with under pressure/compression. Another common reason for losing credit was the response "malleable" which was perhaps indicates confusion with "mouldable".

Question 1 (c) (i)

(c) Fig. 3 shows three lengths of insulated copper wire.

Fig. 3

(i) Circle the term from the list below which describes the type of material that copper is.

Ferrous **Non-ferrous** **Ceramic** **Composite** **[1]**

This question tested candidates' knowledge and almost all candidates were able to identify copper as a non-ferrous material.

Question 1 (c) (ii)

(ii) Give **two** reasons why copper is suitable for electrical wires.

1 .....

.....

2 .....

.....

[2]

Candidates generally performed well on this question with the majority correctly referring to the conducting properties of copper. Some candidates did not gain credit because their engineering vocabulary was not specific enough and they only gave vague descriptions of the metals' conducting properties. Ductility, corrosion resistance and flexibility were all equally represented in candidate responses. Some candidates gave malleability as a reason for copper being suitable for a wire which gained no credit, likewise, nor did references to copper being inexpensive.

Question 2 (a)

2 **(a)** Some modern bicycles are made from composite materials such as carbon fibre.

State **two** benefits of using carbon fibre in bicycle manufacture.

1 .....

.....

2 .....

.....

[2]

There were many creditworthy marking points for this question and candidates performed correspondingly well. By far the most common correct responses were lightweight and strong. Common responses not worthy of credit included hard and malleable which probably indicates a misconception of candidate understanding of these properties.

Question 2 (b)

(b) Engineering materials are often selected according to their properties.

Complete the table to explain the meaning of each property and give an example of a metal having that property.

The first one has been done for you.

Property	Meaning	Metal
Hardness	Resistance of a metal to being deformed, not easy to bend, cut or shape.	Tungsten
Machinability		
Malleability		
Corrosion Resistance		

[6]

For each property there were several metals that would gain credit and candidates generally performed well with this.

Some candidates gave responses which were too vague to gain marks by referring to steel without qualifying which kind or grade, clearly this can significantly affect the property of the steel.

Some candidates also gave materials that were not metals which does not answer the question, probably indicating a lack of attention to detail when reading the question and an area where centres can help to prepare their candidates better.

Marks were commonly lost for the meanings because the stem of the question/property was given as the response and is highlighted with the exemplar responses below which were chosen to specifically clarify these points.

Exemplar 1

Property	Meaning	Metal
Hardness	Resistance of a metal to being deformed, not easy to bend, cut or shape.	Tungsten.
Machinability	how easy it is to cut bend and shape.	aluminium.
Malleability	how easy it is to bend and shape	Lead.
Corrosion Resistance	the resistance of oxidisation	Stain less steel.

Metal: The candidate has given three metals all of which are correct examples of metals with those properties. Note that the type of steel is specified, albeit with spelling that could be improved. All three of these metals gained a mark each.

Meanings: This is a good example of a candidate giving a meaning of the property without simply returning the wording of the question from the first column. For machinability the candidate has clearly referred to the ease of cutting the material. Likewise, corrosion resistance is clearly linked to resistance to oxidation (rusting or chemical reaction were also allowed). Both gained a mark.

Malleability was not worthy of credit because the answer was not specific enough. Words to the effect of hammering into shape without breaking would have been a more appropriate response.

Exemplar 2

Property	Meaning	Metal
Hardness	Resistance of a metal to being deformed, not easy to bend, cut or shape.	Tungsten
Machinability	It can be used in Machines.	Iron
Malleability	It is ~~easy~~ easy to bend, cut and shape	Copper.
Corrosion Resistance	It is resistant to ~~corrosion~~ corrosion.	~~Iron~~ Zinc

By contrast exemplar 2 demonstrates both lack of specificity and simply restating the question.

Metal: Copper and zinc are both credit worthy responses however iron alone is not specific enough and would require the type of iron to gain a mark.

Meaning: The candidate's responses to machinability and corrosion resistance are simply just restating the wording given in the first column of the table and so do not show evidence that the candidate understands the meaning of the properties.

Question 2 (c)

(c) Relative cost is one characteristic of engineering materials.

Name **two** other characteristics that you would consider before ordering engineering materials.

1 .....

2 .....

[2]

A large majority of responses to this question did not gain credit because they gave properties of the materials as opposed to characteristics. The characteristics examined are clearly listed in the specification. Another reason why some candidates did not gain credit was by responding with cost, this being given in the stem of the question. This is an area were centres could help candidates improve examination technique.

Question 3 (a)

3 Fig. 4 shows a drilling machine.

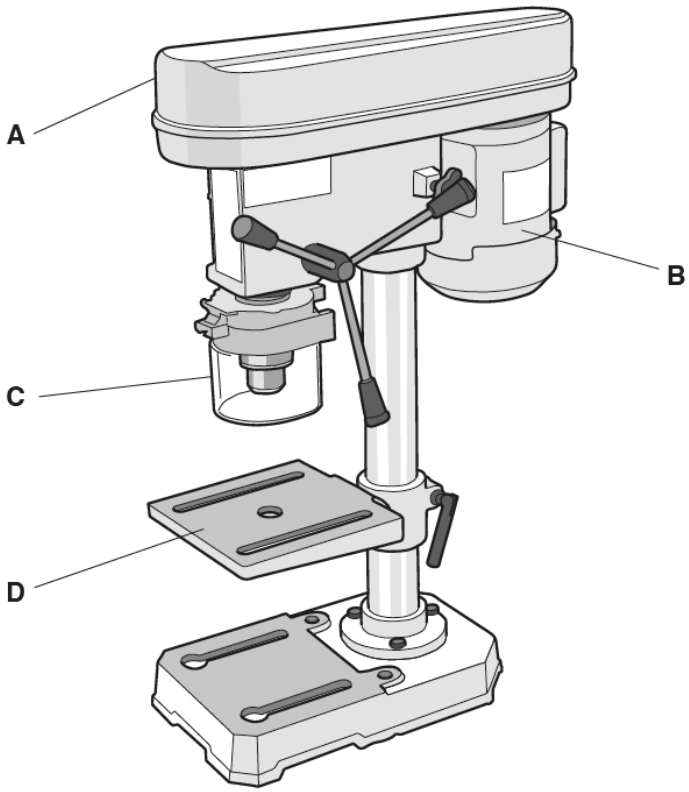


Fig. 4

(a) Name the **four** parts of the drilling machine that have been labelled in Fig. 4.

A .....

B .....

C .....

D .....

[4]

This question tested candidate recall and knowledge.

Many candidates correctly identified B as the motor and the vast majority of candidates correctly identified C as the safety shield/guard.

Far fewer candidates identified D as the table and very few identified A as the pulley housing.

Question 3 (b)

(b) Name **three** safety features you may find on or near to a drilling machine.

1 .....

2 .....

3 .....

[3]

There were several responses for which candidates could gain credit and it was clear where candidates had experience working with such machinery in workshops, these candidates scored highly.

Some candidates gave either PPE or examples of PPE, which did not gain credit, as one or more of the responses and this limited the marks of these candidates.

Some candidates gave vague responses such as "boxes around the drill" although descriptions of a safety area/yellow floor markings did gain credit.

Question 3 (c) (i)

(c) (i) State what is meant by the term 'risk assessment'.

.....

.....

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

This question was looking for a response to show that the candidate was aware that a risk assessment identifies hazards, with procedures/strategies given to mitigate those hazards.

Candidates who did not gain credit for this question commonly mentioned only identifying hazards involved with an activity, machine or process, not linking these to mitigating strategies. Alternatively they did not answer the question set, but instead described an example of a mitigating strategy, such as wearing PPE.

Question 3 (c) (ii)

(ii) Describe **one** example of a risk assessment being applied in a workshop.

.....

.....

.....

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

In general, this question was answered well by candidates probably as a result of their practical experience working with machinery in workshops.

The first mark was given for identifying a hazard. The second mark was only given if the mitigation was directly related to the hazard given. Examples of which are given below.

Credit was not gained in some instances because a mitigation was given but was not related to a specific hazard.

Other candidates gave two mitigations for different risks or two risks and no mitigations when one risk only is asked for in the question.

Exemplar 3

A risk assessment for using a lathe would include wearing safety goggles so no swarf gets in your eye

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

The candidate has clearly stated the hazard and given a mitigation to the hazard, the fact that the order is reversed is irrelevant, and so 2 marks were given for this response.

Exemplar 4

having to ~~enter~~ wear PPE when useing a lathe.

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

In contrast, although the candidate has provided a mitigation, which itself is quite vague, the candidate has not associated the mitigation with a specific hazard and so no marks were given for this response.

Question 4 (a)

4 Fig. 5 shows a door number plate that has been made from acrylic sheet 125 × 125 × 5.

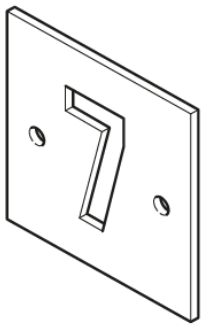


Fig. 5

(a) Use the statements below to complete the table to show the correct order of stages in making the number plate.

Three stages have been done for you.

Clamp work securely and drill holes for screws

File down to marked lines

~~**Put work in bench vice**~~

~~**Mark out number 7 and centres for screw holes**~~

Using a coping saw cut inside number 7 and remove waste

~~**Remove burrs and clean edges**~~

Drill a series of holes inside number 7

Stage	Process
1	*Mark out number 7 and centres for screw holes*
2	
3	
4	*Put work in bench vice*
5	
6	
7	*Remove burrs and clean edges*

[4]

Generally, candidates were able to put the processes into the correct sequence to make the number plate.

Some candidates were aware that they had made a mistake and corrected their mistake. It was good that the corrections made were always clear as to the actual intended answer. In most of the instances were a mistake was made early in the filing of the boxes candidates lost a lot of marks although credit was given for partially correct sequences that would be (mostly) successful even when the actual process was written against the wrong stage.

Question 4 (b)

(b) State **two** advantages of using a CNC laser to cut out the number plate shown in Fig. 5.

1 .....

.....

2 .....

.....

[2]

Several marking points were given credit and candidates generally scored well on this question.

Common credit worthy answers referred to the increased accuracy, precision or finish of CNC laser cutting or the reduced time or labour insensitivity of CNC laser processes.

Question 4 (c)

(c) When setting up the CNC laser cutter, the position of the blank and the material to be used should be considered.

State **two** other considerations when setting up the CNC laser cutter.

1 .....

2 .....

[2]

It was clear from responses if candidates had had prior practical experience of using CNC laser cutters. These candidates commonly referred to the power of the laser, the depth of the cut or the thickness of the material.

Question 4 (d)

(d) A similar door number plate is to be made from metal.

Name **two** different CNC processes that could be used to produce the item.

1 .....

2 .....

[2]

There were a wide range of responses that were acceptable for this question and candidates scored highly with this question.

Some candidates gave responses that were off specification and out of the normal remit of what would be expected by a L1/L2 qualification and gained credit for these responses.

Marks were not gained for giving responses for CNC process that would not achieve the desired manufacture such as CNC lathe. Nor was credit given for 3D printing as a response due to the number plate being made from metal clearly stated in the question, laser sintering/SLS was given credit, however.

Question 5 (a) (i)

5 Temporary fastenings are often used when developing and trialling new engineered products.

(a) An example of a temporary fastening is shown in Fig. 6.

Fig. 6

(i) Name the component shown in Fig. 6.

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

Lack of specificity in candidates' responses resulted in many candidates not gaining credit for this question. The required response was 'self-tapping screw'.

Question 5 (a) (ii)

(ii) State **one** use for the component shown in Fig. 6.

.....

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

Nearly all candidates who successfully identified the self-tapping screw were able to give a correct use for it.

Question 5 (b)

(b) Name **two** other types of threaded fastener.

1 .....

2 .....

[2]

Generally, candidates scored well on this question because there were a large number of responses that would gain credit and they would have had practical experience of the fastenings. However, marks were lost when two parts of the same fastening were given.

This question also exemplified loss of marks for vague responses; in this case "screws" was common.

Given this question's simple level of demand, the number of no responses and responses that were quite clearly incorrect because they were not threaded (such as nails or glue) was quite high. This could be result of candidates over-thinking the question.

Question 5 (c)

(c) Explain why temporary fastenings may be preferred to permanent fastenings.

.....

.....

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

Many candidates gained a mark by giving a response relating to gaining access to/or disassembling a product. However, not all candidates followed this up by explaining why access might be required even though there were several responses that would have gained this mark, including repair, replace, recycle etc... This is probably another instance of candidates not explicitly understanding the meaning of command words.

Question 5 (d)

(d) Explain how digital communications can be used to support research and development of new engineered products.

.....

.....

.....

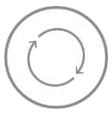
.....

.....

..... **[4]**

Candidates who scored highly on this question drew on several different points relating to how digital communication can support research and development, including sharing of ideas; transfer of data/designs; storage of data; CAD; customer surveys/feedback; CNC and rapid prototyping.

The above contrasts with candidates who simply repeated the same point in different ways or simply listed a range of different apps for communicating/sharing ideas.

	**AfL**	A good strategy is to train candidates to relate the number of marks available for a question to the number of points that need to be made in the response. It should be made explicit to candidates that in general a list of 4 nouns (by way of example) will not be a good way of addressing 4 marking points unless the command verb in the question does ask for a list and instead they should be looking at writing at least 4 different sentences.

Question 6 (a)

6 A delivery system for materials and components is described as JIT.

(a) State what JIT means.

J ..... I ..... T ..... **[1]**

This was a knowledge question which candidates either knew and gained credit, or were clearly guessing.

Question 6 (b)

(b) Explain why JIT delivery helps to keep production costs low.

.....

.....

.....

.....

.....

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

Candidates who did not know the meaning of the acronym JIT struggled to gain any credit in this question.

Conversely candidates who explained the effect of materials arriving just before the time they are needed to go into the production line thereby saving the cost and space of storage and warehousing and the more rapid return on costs of materials scored highly.

In many instances candidates' marks were limited because they either made vague repetitions of the stem of the question, or, repeated the same marking point(s) several times instead of developing their explanation.

Exemplar 5

As it means less inventory is being used, therefore there is never wasted space and no wasted money on a premises. Also, this means stock are always working therefore no waste of money due to stock doing nothing

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

This example shows how the candidate has given a reason related to inventory, linked to wasted space. They have developed their reason specifically to the reduction of cost. The response gained 2 of the 3 marks.

The third mark would have been given if the candidate linked the above to the materials arriving as they are needed (or just before) to go onto the production line.

Question 6 (c)

(c)* Discuss the statement, 'Globalisation is good for engineering companies but has a major impact on local industry.'

.....

.....

.....

.....

.....

..... **[6]**

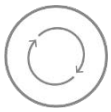
Successful responses to this question provided a balanced discussion of the merits of globalisation and the impacts on local industry. They included several points relating to both sides of the discussion and developed these points.

It was good to see that many of these responses recognised opportunities that globalisation gave to local industries such a niche, high value and bespoke product markets.

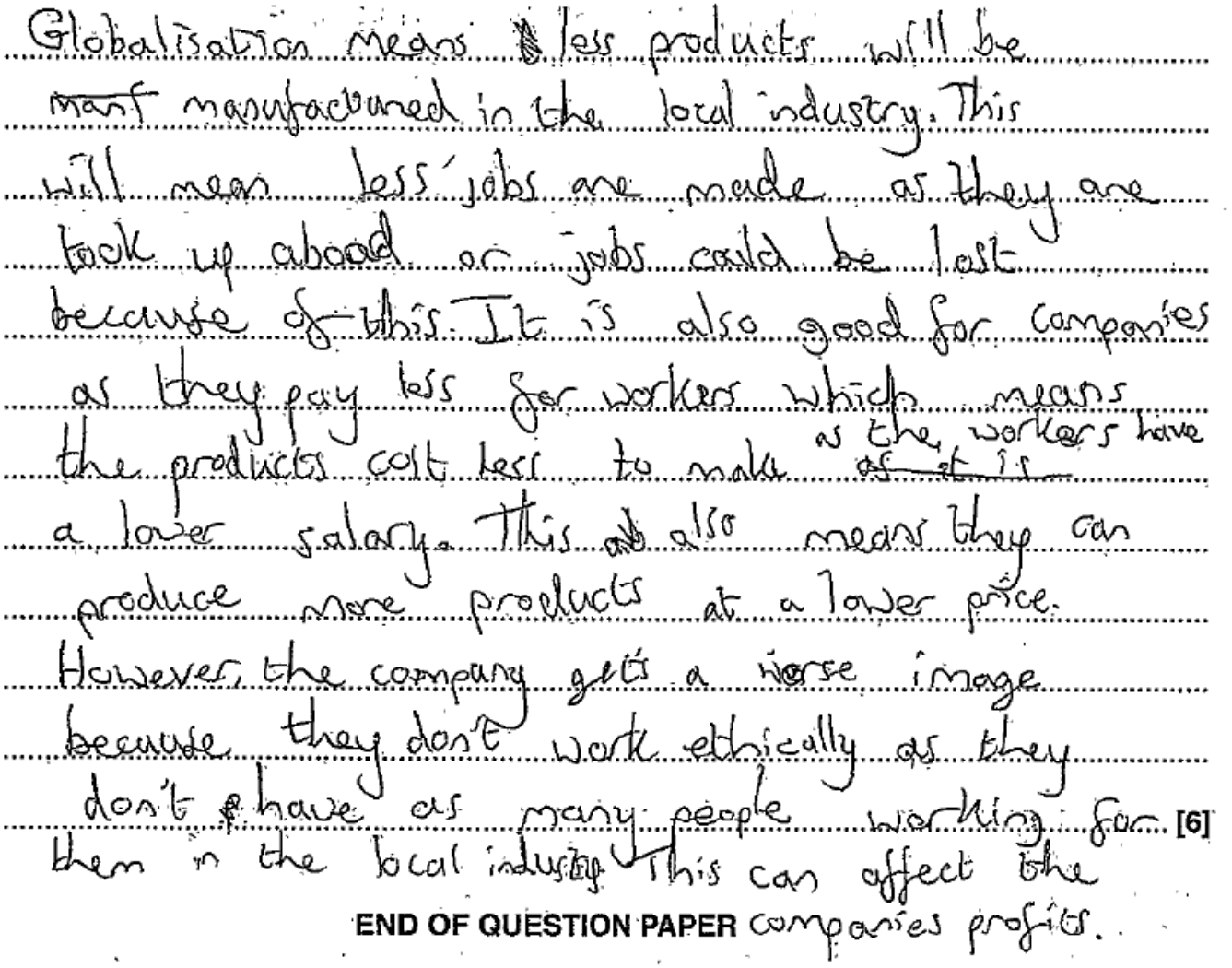
Good use was made of the answer space and where needed continuation sheets were used too.

This is in direct contrast to the least successful responses which commonly used only a few of the answer lines and/or repeated the same point often in the same way. These features are highlighted in examples below.

It was pleasing to see that the percentage of no responses to this question was very low although a significant number of candidates gave only very short responses.

	**AfL**	Candidates, especially those who are less confident with exams, can be intimidated by 6 mark questions and the large number of available response lines, this can encourage candidates to not respond or to hurry a response. In R109 the 6 mark question represents 10% of the paper's total marks and so can make a significant difference to the final number of marks candidates' achieve. This point and the importance of providing a response to this type of question should be made explicit to candidates when preparing them for examinations, with the aim that all candidates provide a response that fills most available response lines. Candidates would also benefit from being trained in deconstructing questions to identify key points that need to be addressed. This will help them to produce more broadly balanced arguments with a greater probability of including the indicative marking points.

Exemplar 6


Globalisation means less products will be manf manufactured in the local industry. This will mean less jobs are made as they are took up abood or jobs could be lost because of this. It is also good for companies as they pay less for workers which means the products cost less to make as the workers have a lower salary. This ab also mean they can produce more products at a lower price. However, the company gets a worse image because they don't work ethically as they don't have as many people working for them in the local industry. This can affect the companies profits. [6]

END OF QUESTION PAPER

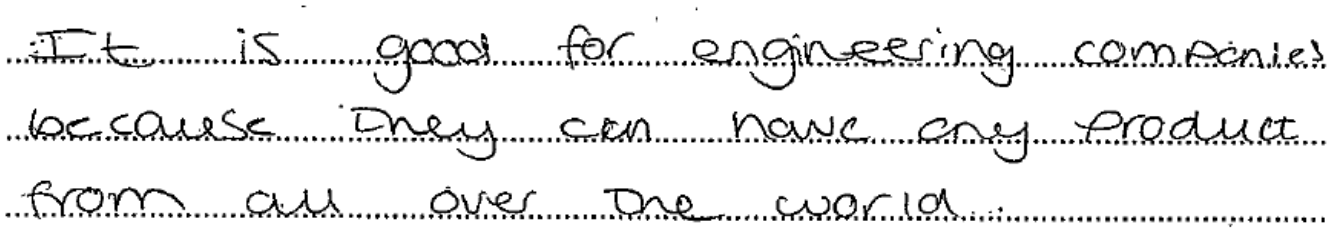
Exemplar 6 shows a good response to 6 (c) although in lines 5 and 6 there is an element of lack of explicitness; are they referring to globalisation or the impact on local industry?

In several places in the response the candidate has written about both the advantages of globalisation and the impact that this can have on local industry.

Ideas that are introduced are developed and explained and full use has been made of the answer space provided.

Mark 6 could have been gained in this response by, for example, writing about globalisation and environmental or legislative issues, or even the opportunities for niche/bespoke high value manufacturing in local industry.

Exemplar 7



This is in direct contrast to exemplar 6 and a typical example of a response that has gained no credit for this question.

Just a small amount of the available answer space has been used which will immediately reduce the number of indicative marking points the response could possibly meet.

The response is also written with a lack of specificity about which element of the question, globalisation or local industry, it is referring to. More ideas relating specifically to the elements in the stem of the question would help development or explanation of those ideas, which in turn would greatly increase the chances of meeting credit worthy marking points.

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