OCR
Oxford Cambridge and RSA

Cambridge Nationals

Engineering

Level 1/2 Cambridge National Awards in Engineering **J830-3, J840-3**

Level 1/2 Cambridge National Certificates in Engineering **J830-3, J840-3**

OCR Report to Centres June 2015

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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R105 Design briefs, design specifications and user requirements

General Comments

This was the second series of the R105: *Assessing client briefs, specifications and user requirements* exam paper. Following on from the comments provided in the first report to Centres it is clear that despite the infancy of the qualification and unit, a large number of candidates were able to successfully access the paper. In addition, the paper was successful in discriminating across the ability ranges.

It is worth emphasizing here that Centres should cover the entirety of the content set out in the specification. Once the content has been covered it is advised that Centres spend some time preparing candidates for the examination using the specimen papers and, with growing availability, the past papers for the examination. This should allow candidates to answer the whole paper with sufficient understanding and depth.

Centres must also ensure that they prepare candidates with an understanding of the command verbs that are used within questions. This is still a recurring element of improvement evidenced in the answers provided. At times it is clear that candidates are not always answering questions in the style expected of the command verb. For example; when a question command verb is 'Explain' or 'Describe' candidates are answering with one-word answers which limits their ability to access the full marks available for the question.

Comments on Individual Questions:

Question No. 1

Part 1a of this question requires candidates to join client requirements to product features for a medication container. On the whole candidates answered this question successfully but as per previous sessions it is advised that candidates spend time carefully looking at the criteria before joining the options together. Some candidates appear to have made decisions on their selections very quickly which resulted in lots of lines drawn on the question, making the identification of marks difficult. In general however, the question was answered well and acted as an affective starter to the exam.

For part 1b, candidates were required to give two reasons why prototypes are tested. The question was generally answered well, but for future reference centres need to ensure that they encourage candidates to focus on specific reasons. Where this question generated poor responses, generally due to the lack of a focused answer, a vague response was given that did not consider the reasons why testing of prototypes aids the design development process.

In part 1c candidates were asked to explain what was meant by the term 'error proofing.' It was clear that candidates had a varied knowledge of 'error proofing' and in most cases referred to quality checks of components. Centres are advised to review their delivery of 'error proofing' to ensure candidates fully understand how 'error proofing' can be built into the design of components, products, processes or systems.

Finally, in question 1d candidates were required to give two reasons why a designer might return to the client to discuss the original design brief. Overall candidates answered this well and clearly understood how research, budget, material or design changes could have an impact on the brief.

Question No. 2

In part 2ai of this question, candidates had to give two strengths of one phone compared to another. On the whole this question was answered relatively well, but as per other questions in the paper, some candidates gave very general or vague responses that lacked justification or specific application within the given product. Candidates tended to focus on the technological function of the product rather than focusing on the strengths of its design and manufacture, particularly strengths associated with how the product is engineered.

Part 2 aii, asked candidates to consider how ergonomics had been considered in the design of the handset. Again, as per part ai, this question was answered relatively well with candidates achieving good marks. However, it is still clear that in most cases, candidates were basing their answers on generic presumptions related to ergonomics rather than considering the design of the handset and the major ergonomic constraints that would be a key focus for the designer during the development of the handset.

Part 2b required candidates to consider constraints that a manufacturer would have to consider when producing mobile phones. This was generally answered well, as per the first two parts of this question. Candidates clearly have a good understanding of the types of areas that manufacturers must consider. To develop further, centres should try to ensure that candidates focus on the manufacturing element of this question, considering how the processes involved in the manufacture would need to be considered rather than the design of the product itself. Most of the answers awarded were related to the considerations that must be given to elements of the design or products features, which although viable, highlighted that there was scope for further development if candidates had considered the areas for consideration within production and manufacturing.

In part 2c, candidates were asked to consider methods of gathering information through research. This was a strongly answered question. Most candidates were able to consider and provide multiple methods of gathering information in both primary and secondary format. The majority of answers focused on traditional methods of research but centres could equally consider and develop candidates' knowledge of new and innovative approaches of data capture and target audience assessment through the use of contemporary information systems.

Question No. 3

Part a of this question, was split into three parts to assess candidate understanding of how the size, lifecycle and working environment can influence the design of a microwave.

In part 3ai, candidates were asked to describe how ‘size’ could influence the design. Overall candidates managed to provide relatively good responses to this first sub-point of the question. Answers considered accommodation of food items and location within spaces. Centres are encouraged to develop candidates' ability to answer with greater depth of response with particular focus on how the designer would consider size rather than the end user. As per the other responses in the latter parts of this question, candidates need to respond to the action verb in the question and explain how the ‘size’ might influence the design rather than providing more simplistic statements.

Part 3aii, lacked the quality of response provided in 3ai. Again, issues with providing explanations rather than simplistic responses was evident, but it was clear that, on the whole, candidates did not understand the full scope of product lifecycle with answers generally focusing on end of life disposal. Many candidates achieved good marks here but centres are advised to develop a more thorough awareness of the breadth and depth of full lifecycle consideration from product conception to disposal. Many answers given focused on how long the product will last which, despite being generally accurate missed the key focus of the question where candidates

should have discussed the development process, consideration of materials, energy usage over time and subsequent disassembly and recycling of the component parts.

In question 3a part iii, candidates did not grasp the true focus of the questions intent. Some good answers were provided, but on the whole, responses had a tendency to be generic and not fully consider the decisions made by the designer in the development stages of the microwave based on its final working environment. In addition, as per parts i and ii, the responses failed to fully act on the command verb and explain how the designer considered the working environment rather than short, generic statements.

In part b of question 3 candidates were asked to provide two anthropometric measurements that would be important in the design of the handle for the microwave. Some answers provided here were good, but the vast majority tended to focus on the actual dimensions of the handle itself. The question encouraged candidates to consider the actual anthropometric, human measurements that would then be used to define the actual dimensions of the product. This distinction is important for centres to consider when preparing candidates for questions such as this one. Marks for responses related to the sizes of the handle were not awarded as this was not the focus of the question.

In question 3c, candidates had to give two reasons why microwave ovens would be available in a range of specifications. This question was answered relatively well. Candidates provided responses related to the requirements of different users, different power ratings and accommodation of different food types.

Question No. 4

Question 4 consisted of five parts. This question focused on the use of standard parts, how this aids disassembly for maintenance and tolerances. As highlighted in previous series, it is important that centres understand the engineering focus of the design paper when teaching and ensure continual reference to the specification.

Responses to part 4a of this question were generally good. Candidates were able to identify two standard components from the diagram of the plug. Centres are advised that candidates should be able to name standard components using correct terminology.

In part 4b, candidates were asked to give two features that make disassembly and maintenance of the 13 amp plug easy for the user. Again, on the whole most candidates were able to give reasonable responses to this question. It is important that candidates develop knowledge of the design features incorporated into such products to assist easy assembly/disassembly and maintenance. The use of standard parts and a multiple body plastic casing with easy located internal components are important attributes of the design and were considered by those candidates that answered this question successfully.

In part 4c, candidates had to consider why components are manufactured to close tolerances. Although many candidates answered this relatively well, there is some lack of understanding in relation to tolerance. Most were able to state that parts are manufactured to close tolerances to ensure that the components fit together properly but only a minority were able to discuss the inherent variation in manufacturing and the associated difficulties of trying to produce components to exact dimensions. As mentioned earlier in this report, it is important that centres recognise the engineering nature of this design paper. This is where areas such as tolerances and the consideration of manufacturing constraints when designing components are important.

In question 4 part d, candidates were asked to give two benefits to a manufacturer of using standard parts in their products. On the whole answers to this question varied greatly. Some candidates did not have a clear understanding of what standard components were, how they

were used or what benefits their use gave to manufacturers. Many candidates described the benefits of using standard components in relation to their ability to be easily assembled by operators or end users. This was missing the major focus of the question. Those candidates that answered this question well were able to relate the use of standard components to the reduction of stock parts having to be kept in storage, the reliable accessibility of the components and the guaranteed quality. Many responses stated that they were cheap. Answers related to cheap were not given unless qualified with reference to the quantity of manufacture and the subsequent ability to purchase in bulk, reducing the unit cost of individual components.

Question No. 5

Question 5 focused on the areas of market pull and technological push in part a and, registered designs, trademarks and patents in part b. The majority of answers to these questions were poor, lacking clarity and understanding. However, in a few cases, some candidates had obviously covered the topics and were able to give reasonable responses.

In part 5 a, students were asked to describe how market pull and technological push influence the design of new products. The majority of candidates were able to provide answers related to market pull and could explain how consumer demand for new products can drive the design and development of new products. However, many of these answers were delivered in simplistic statements that failed to develop the point made or cover the range of influences market pull can have on product development. Centres are advised to remind candidates to act on the command verb in the question and build on the points they make. Responses related to technological push were generally poor and on the whole, showed a lack of understanding of the concept. Centres are reminded to ensure the specification is covered in its entirety so candidates have the best opportunity of achieving the highest marks.

Part 5 b was split into three parts. The stem of the question asked candidates to explain how three safeguards, (i) registered designs, (ii) trademarks and (iii) patents can be used by companies to protect their products. On the whole, candidates were able to state how each of the above safeguards helped to hinder other companies copying ideas, products or technology but it was clear that the majority of candidates did not fully understand the exact differences or specific details of each method, sometimes resulting in a repetition of answers. Centres are encouraged to ensure candidates understand the differences between each of the safeguards and how and where they can be applied to protect products.

Question No. 6

Question 6 consisted of three parts. The first part required candidates to give reasons why two symbols may be labelled on a product. Part b, required candidates to discuss how developments in materials impact on the design of new products and partc required candidates to discuss the effect of cultural and fashion trends on the aesthetic design of new products.

Part 6a was answered well. On the whole, candidates were able to identify the symbols and give reasons why they would appear on products. In only a few responses did candidates not provide suitable answers. In these cases, candidates may have referred to recycling instead of disposal for the first symbol and failed to qualify ‘efficiency’ with ‘energy efficient’ for example. Centres are advised to encourage candidates to always support responses such as ‘efficient’ with suitable application and qualification of how or what this might influence or refer to.

Part 6b was not answered well by the vast majority of candidates. The responses that were generally given, lacked specific examples or details of how advancements in materials have changed the characteristics, properties and overall performance of products. A common response referred to materials becoming ‘cheaper’ which was very rarely qualified with a specific

example. Where candidates did achieve marks, reference was made to the improved properties of modern materials such as reduced weight, strength or rigidity. Only a small majority of candidates provided responses that gave an actual example of a material or product and how this has impacted on design and manufacture or improved the performance of the product in question.

In part 6c, candidates failed to pick up on the full scope of the question. Centres are reminded to ensure candidates fully read, assess and analyse the question before commencing their response to ensure they cover the full scope of the content. This is prevalent in this question but is perhaps one of the many reasons why candidates have missed marks in other questions. In this particular example, some excellent responses were provided that detailed how specific cultural or fashion trends could have an impact on customers or products but generally this was not linked or developed to encompass the subsequent impact on the aesthetic of the products in question. Centres are also reminded to develop candidates' ability to write extended responses. Some responses were written in bullet point format which, although some excellent points were made, candidates are also being assessed on their ability to write extended prose and therefore may not have achieved the maximum marks of which they were capable. Also, in some instances, generic responses were given by candidates that failed to illustrate a high-level of understanding of cultural, fashion trends and aesthetics within products. Centres are remained to ensure they cover the full scope of the specification in depth to ensure candidates achieve maximum marks.

R106 Product analysis and research

General Comments:

Samples from Centres were received for moderation before the deadline date. All Centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate had a Unit Recording Sheet (URS). Centre administration was efficient.

Standard of assessment by Centres was generally consistent. Marks had been clearly entered on the URS and totalled correctly. There were no errors in transferring marks online. The correct candidates had also been included in the samples received.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. There was no further evidence of annotation on candidates' work which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO3 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the Centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the candidate and should not be used as a sole source of evidence.

Comments on Individual Learning Outcomes:

LO.1
Candidates made a good attempt at this LO by identifying commercial production methods, end of life consideration and also legislative requirements such as CE marking. The function and operation of products are not explicitly required for this LO, which were sometimes covered by candidates.

LO.2
On the whole this was well attempted with candidates demonstrating a good range of research skills. The strengths and weaknesses were sometimes a little weak (and sometimes not evident at all), with the quality of research methods used often compensating for this.

LO.3a and b
Again this was very well attempted. Most candidates were able to provide a good analysis of a product through disassembly.

Conclusion and Recommendations

Centres provided efficient administration with the correct paperwork and samples being submitted.

Level of detail on the URS (and on candidates' work) might be improved which would assist with the moderation process.

Both LO1 and LO2 were generally well attempted, although the quality of research often made up for the lack of strengths and weaknesses in LO2.

For LO3 candidates could evidence disassembly through photographic evidence or similar. A witness statement, or similar, should be used to corroborate how safely and independently candidates worked and if they used the appropriate tools. Centres might consider alternative means of providing evidence (e.g. videos of disassembly being performed) or can use the pro-forma witness statement provided with the Live Assessment.

R107 Developing and presenting engineering designs

General Comments:

Samples from Centres were received for moderation before the deadline date. All Centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate had a Unit Recording Sheet (URS). Centre administration was efficient.

Standard of assessment by Centres was generally consistent. Marks had been clearly entered on the URS and totalled correctly. There were no errors in transferring marks online. The correct candidates had also been included in the samples received.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This is especially the case where the LO includes credit or otherwise for the amount of teacher support given, and where the candidate had to give a presentation. There was no further evidence of annotation on candidates' work which would also help with the moderation process.

Comments on Individual Learning Outcomes:

LO.1
LO1 was often well attempted. Most candidates were able to produce good quality 2D and 3D sketches applying techniques including shading and rendering. Labelling was good, and in most cases there was evidence of annotations. CAD, in various forms, had been used to enrich and develop the design. It would be useful if centres could confirm the amount of assistance given to learners in the commentary on the URS in future submissions.

LO.2
There was evidence that candidates had attempted isometric and oblique drawings i.e. using formal drawing techniques. More successful candidates were able to develop their drawings by adding detailed annotations and dimensioning. In many cases candidates were able to clearly evidence knowledge from other units e.g. R106

LO.3
This LO was often well attempted. There was often good evidence of the use of CAD to present a final design. Final presentations, however, sometimes lacked detail to confidently secure marks in the higher bands.

Conclusion and Recommendations

Centres provided efficient administration with the correct paperwork and samples being submitted.

Level of detail on the URS (and on candidates' work) might be improved which would assist with the moderation process. This is especially the case for LO1 where credit is given for amount of teacher assistance or otherwise, and LO3 where candidates may give a presentation.

LO1 was often well attempted. There was good evidence of sketching, appropriate annotation and detailing, and the use of computers to produce augmentation.

LO2 requires candidates to present designs in 2D and 3D using formal drawing techniques. This was well attempted by many Centres, although some Centres may develop these skills further with candidates.

For LO3 CAD was attempted with varying levels of success, but with some excellent examples. However, often final presentations lacked sufficient detail .

R108 3D design realisation

General Comments:

Samples from Centres were received for moderation before the deadline date. All Centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate had a Unit Recording Sheet (URS). Centre administration was efficient.

Standard of assessment by Centres was generally consistent. Marks had been clearly entered on the URS and totalled correctly. There were no errors in transferring marks online. The correct candidates had also been included in the samples received.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. There was often no further evidence of annotation on candidates' work which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the candidate, and should not be used as a sole source of evidence.

Comments on Individual Learning Outcomes:

LO.1a and b
Most candidates were able to provide an excellent interpretation of the product specification. Where candidates failed to access the higher mark bands the interpretation was weak or generic.

For some candidates a detailed plan along with Gantt chart was often produced for the making of the prototype. This was often relatively detailed. Some candidates produced a weak plan with little reference to tools, equipment and materials, and so failed to access the higher bands.

LO.2
There was evidence of candidates producing a risk assessment, identifying hazards and how they can be mitigated, using safety equipment and PPE. There was also good evidence of the safe use of tools and materials, which was backed up by a witness statement. However, some candidates in some centres failed to address these crucial points relating to health and safety.

LO.3
There was good evidence of a prototype being made both manually and sometimes using rapid prototyping. The inclusion of annotated photographs showing stages of production is extremely useful for the moderation process. There was also evidence of materials selection in many cases.

LO.4
This was perhaps the weakest LO for some centres. It requires an evaluation of the production plan alongside the prototype, and suggesting improvements. It also requires an assessment of personal performance including strengths and weaknesses. Candidates might also consider here improvements both to the finished prototype and also to the process of prototype manufacture.

Conclusion and Recommendations

Centres provided efficient administration with the correct paperwork and samples being submitted.

Level of detail on the URS (and possibly on candidates' work) might be improved which would assist with the moderation process.

In LO1 interpretation of the specification was often good, but sometimes too generic and lacking in detail. Plans were often quite detailed, and a Gantt chart produced.

For LO2 there was good evidence of safe working practices, and often the witness statement was used successfully. Some candidates, however, failed to address this fully.

In LO3 there was evidence, in most cases, of a prototype being produced (as seen in photographs of the finished item), but not always of a step-by-step approach.

LO4 requires evaluation of the finished item against the plan, and also reflection on personal performance, strengths and weaknesses. In some cases this was well attempted, but in others not fully.

R109 Engineering materials, processes and production

General Comments:

Candidates had been generally well prepared for the examination and, in most cases, had attempted all of the questions on the paper, although responses were frequently rather lacking in detail.

In a number of cases there was evidence that candidates had not read questions carefully enough before answering, resulting in a loss of marks. It is most important that candidates take the time to read through the question paper before attempting to answer questions.

Responses to questions relating to engineering materials were generally rather varied, and knowledge and understanding of 'smart' materials and their uses was particularly limited. Basic engineering processes were quite well known, but this was not the case for more advanced or less commonly used processes.

In questions where candidates are asked to describe or explain processes or procedures, it should be noted that one-word or over simplistic answers are not suitable responses. This was often the reason for candidates failing to score high marks in questions relating to modern technologies.

Comments on Individual Questions:

Question No.

1(a)(i) Most candidates were able to identify two materials in the list that are polymers although, in a number of cases, one polymer and one metal were given in the response.

1(a)(ii) A number of candidates gave 'polycarbonate' or 'high speed steel' as their response to this question, but the correct response of 'concrete' was most frequently seen.

1(a)(iii) This question was well answered by most candidates, with Brass and Copper being the most frequently named non-ferrous metals. There was a little confusion between ferrous and non-ferrous metals by some lower scoring candidates, and Stainless Steel and High Speed Steel were occasionally given as responses to this question.

1(a)(iv) Most candidates were able to identify an alloy in the list given but, in a significant number of cases, it appeared that candidates had used guesswork to choose their example. Zinc appeared quite frequently, as did polymers such as ABS and PVC.

1(b) Most candidates scored at least one mark on this question, generally by making reference to 'reforming' thermoplastics. The second mark was given for reference to reheating the plastic to soften it, and 'melting' was also allowed. A few candidates confused thermoplastics with thermosets and suggested that thermoplastics cannot be reshaped.

1(c) Explanations for the use of alloys rather than pure metals were very varied. Higher scoring candidates made the point that alloys were mixtures of metals and provided enhanced properties as a result, whereas many candidates made simplistic statements

such as ‘alloys are stronger / better’ and showed a lack of understanding of the reasons for their use.

2(a) The most frequently quoted property of brass was conductivity, although a few candidates did suggest that brass would not conduct electricity. Other properties, such as malleability and corrosion resistance, were also seen, but ‘strong’ and ‘high melting point’ regularly appeared in the responses presented.

2(b) Most candidates were able to name two engineering materials often supplied in sheet form, and steel and aluminium alloy were the most commonly used examples. A small number of candidates thought that cast iron was also an example, and ‘tin’ rather than tinplate was seen on a number of occasions.

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2(c) Knowledge of smart materials and their uses was rather limited, particularly with regard to Quantum Tunnelling Composite (QTC), for which many candidates offered no response at all. Most candidates showed some knowledge of Shape Memory Alloy, but few responses gave sufficient detail for the three marks available, making no reference to the external stimulus needed to effect the necessary reaction.

3(a)(i) Casting and forging were the most frequently seen correct responses to this question. In some cases, however, candidates had neglected to take account of the fact that the support block was made from steel, and had suggested plastics forming processes such as injection moulding and vacuum forming.

3(a)(ii) Most candidates scored at least one mark on this question by giving a valid advantage of forming processes. Less waste material produced was a popular answer, and quicker was also allowed, provided it was qualified by making reference to the time saved by not having to carry out machining operations.

3(b) This question was generally well answered, with welding, brazing and riveting all frequently seen in the responses presented. A few candidates lost a mark by making reference to ‘screws’, and glueing was too vague to qualify for a mark unless reference to cyanoacrylate (superglue) or epoxy resin was made.

3(c) This question was not well answered on the whole, with many candidates seemingly unaware of the need for a surface finish on the steel pipe support. Galvanising, painting and powder coating were commonly seen correct responses, but a significant number of candidates only scored one of the two marks available, as some responses were either too vague or inappropriate.

3(d) Some very good responses to this question were seen, with candidates making reference to cost savings, standardisation and the removal of the need to manufacture the components ‘in-house’. In a number of cases, however, candidates had simply mentioned the use and benefits of the nuts and bolts themselves, with no reference to the manufacturer at all.

4(a) Disappointingly, the axes of the milling machine were not well known, and a significant number of candidates offered no response to this question, with others apparently simply taking a guess at the correct axis.

4(b) This question was generally well answered and most candidates scored at least two of the three marks available, although the use of the machine guard was often not mentioned. Where marks were lost on the question, it was normally as result of a candidate missing the focus of the question and giving examples of PPE.

4(c) Most candidates scored well on this question by naming two appropriate material removal processes. Occasionally, however, marks were lost by naming a machine rather than a process, and some of the lower scoring candidates presented completely inappropriate responses.

4(d)(i) Knowledge of the lost-wax investment casting process was extremely limited and very few candidates scored marks on this question, with many offering no response at all. Where responses were presented, these mostly related to the basics of the sand casting process

4(d)(ii) Most candidates were able to name a casting process, with responses referring to either sand casting or die casting. In a number of cases, however, candidates had made entirely inappropriate responses, such as 'injection moulding' and even 'pillar drill'.

5(a)(i) This question was quite well answered, although only the higher scoring candidates presented responses that contained sufficient detail to earn the maximum mark. Most responses included references to the speed and accuracy of the CNC lathe, but few made the direct comparison with the centre lathe needed to justify the comments made.

5(a)(ii) This question was generally well answered, with most candidates naming at least one other CNC machine used in engineering production, the most popular examples being milling machines and laser cutters. In addition to these two machines, it was good to see some candidates mentioning alternatives, such as plasma cutters and water jet cutters.

5(b) A significant number of candidates missed the focus of the question completely and based their responses on the general benefits of using CNC machines, without any reference to the workforce at all. The most frequently seen appropriate responses gave benefits such as reducing the need to work in hazardous conditions, and the reduction in the amount of heavy work to be done.

5(c) It appeared that the term 'additive manufacturing' was not known by a number of candidates, and responses often featured references to assembly line production, soldering, and casting. Where candidates were aware of the term, some very detailed descriptions of an additive manufacturing process were presented, normally relating to 3D printing.

6(a) Responses to this question were often quite disappointing, as a significant number of candidates missed the focus of the question and presented inappropriate information. In these cases, descriptions made general reference to modern technologies without relating their use to the development of new products. Those candidates who had read the question correctly gave responses relating to the use of the Internet and the application of CAD packages in designing and prototyping.

6(b)* There was considerable variation in the type and quality of responses to this question. In a number of cases candidates had, again, missed the focus of the question and gave responses that were simply generic references to the use of modern technologies. Where candidates had taken account of the need to relate the response to 'cost implications', they were able to provide suitable responses relating to initial set-up costs, 24/7 working, and staff training / redundancies.
Marks were awarded in this question for a candidate's quality of written communication, even though technical content might have been weak.

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