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 2017

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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OCR REPORT TO CENTRES

R101 Engineering principles

General Comments:

Many candidates attempted all of the questions on the paper although there were exceptions where some candidates had only attempted a few questions within the entire paper.

Questions Q4(d)(i), 6(a) and 6(b) had a higher incidence of omitting to answer (No Response) than anticipated. For question 4(d)(i), candidates were required to annotate the diagram but may have missed the instruction to do so. Generally, throughout the exam paper, there was 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 and ensure that they have responded to all questions including annotating diagrams where required.

Knowledge of mechanical principles appeared to have improved in some aspects. Candidates demonstrated the ability to perform mathematical calculations reasonably well in two out of the three questions requiring calculation.

Knowledge and understanding of pneumatic systems, hydraulic systems and components, forms a significant proportion of the specification for R101/01. Candidates demonstrated only a limited and basic knowledge of pneumatic and hydraulic system applications. Responses were often lacking in technical terminology. Overall, candidates would benefit from further study of the application and design of mechanical, electrical and fluid power systems. Industrial visits or similar activities could help improve learners' understanding, and support them in being able to competently answer questions such as 1(a)(iii), 6 (a), and 6 (b).

Comments on Individual Questions:

Question No.

1(a)(i) & (ii)	Most candidates achieved full marks for part (a)(i) for correctly matching the terms. Candidates often gave vague answers to part 1(a)(ii) rather than specific applications for the spur gear.
1(a) (iii)	Lower ability candidates found difficulty in providing an appropriate mechanical application.
1(b)(i)	Some candidates used technical terminology such as "kinetic" (although not necessarily required for this question) to provide a correct description for the wind-up torch.
1(b)(ii)	Fewer candidates gave correct examples of potential energy and often gave examples of gravitational potential energy.
2(a)(i),(ii)	Candidates were required to label the diagram with the correct terms for the lever (in this case a fishing rod). The majority of candidates attempted the question but many candidates used incorrect terms such as "force" and "weight". For part (ii), relatively fewer candidates correctly gave the correct class of lever.
2(a)(iii)	Candidates across the ability range were able to achieve marks for this part, with many at least correctly recognising the difference in location of the fulcrum.

2(b)(i) & (ii) Candidates across the ability ranges answered these parts less well than expected, demonstrating little recognition or knowledge of AC to DC conversion.

3(a)(i) & (ii) Candidates performed well on this calculation question with the majority of candidates achieving the 2 available marks. However, some candidates went on to incorrectly present the ratio. For part (ii) error carried forward was allowed when possible, where candidates incorrectly stated the ratio in part (i).

3(a)(iii) Although this question was focused on pulley and drive belt applications, some candidates interpreted the question in terms of mechanical advantage applications. The mark scheme therefore rewarded correct examples relating to mechanical advantages such as “easier to lift the load”.

3(a)(iv) Candidates generally demonstrated a lack of knowledge and awareness of hydraulic pump applications.

3(b) Candidates struggled with communicating an explanation of how the generator works. Marks were awarded where candidates were able to give some explanation of the armature rotating between the coils to produce a current.

4(a) Candidates generally performed well for parts 4(a)(i) and (ii), but relatively fewer candidates correctly gave the correct unit for power.

4(b) The question was very well answered by candidates of all abilities with most candidates achieving the full 3 marks available.

4(c) Candidates at the middle and higher ability range recognised the requirement to multiply the resistance of both lamps to give the correct resistance value. Some candidates did not use this sum to go on to using Ohm’s law to calculate the current, and therefore only achieved 1 of the 2 available marks.

4(d)(i) &(ii) In part (i) candidates were required to annotate the diagram of the multimeter to indicate the correct setting. It appears that candidates may not have read the instruction at the top of the page and omitted to annotate the diagram as required. Some candidates incorrectly selected the AC symbol instead of the DC. Despite this, many candidates gave the correct answer for part (ii).

5(a) This question was about using a compressor to produce and store power for a pneumatic system. Most responses lacked an explanation of how the compressor is used to produce power, however candidates were able to gain a mark for stating the compressed air is stored in the reservoir. Responses generally lacked technical terminology.

5(a)(ii) Although the diagram in Fig. 6 shows a pressure gauge, fewer candidates than expected correctly stated the use of a pressure gauge to measure system pressure.

5(b) Candidates across the ability range answered this question well including references to the use of the ball valves.

6(a) Candidates performed less well than anticipated in their knowledge of applying and combining electrical and pneumatic applications. Marks were awarded for a feasible description.

6(b) Candidates generally struggled to state an appropriate example of a hydro-mechanical application, with candidates too often giving hydraulic applications appropriate to question 5(b)(ii).

6(c)* The majority of candidates attempted this question, with most candidates achieving 2 or more marks. Lower achieving candidate responses were limited to the ability to lift heavy loads and references to excavator equipment. Higher attaining candidates correctly identified that fluids cannot be compressed, and some mentioned the use of a hydraulic pump to create the initial fluid pressure.

The candidates' Quality of Written Communication (QWC) was assessed in this question, and marks were awarded for well written answers, including where the technical content of the response was limited.

R102 The engineered business

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome should not be used for others. This is also the case for work that overlaps more than one unit within the qualification.

Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
This was generally well attempted. Most candidates identified two sectors, and a range of products and services from these sectors. The higher mark bands can be accessed by providing a comprehensive coverage of the sectors, and highlighting a wider range of products and services.

LO.2
This LO was generally well attempted by most candidates. Two and sometimes more companies were identified and their structure analysed. Relationship to other companies – both suppliers and customers – was also evident in most cases.

LO.3
Candidates often provided a clear description of the Engineering Council. Job opportunities within engineering were also often well covered, as were sources of information. Some candidates failed to include entry routes e.g. qualifications and progression in their job opportunities. Rights and responsibilities of employers and employees were mostly well covered. Candidates were able to access marks in high MB2 or low MB3.

LO.4
This LO was generally well attempted with most candidates being able to identify two innovations. Sometimes the innovation aspect of the item was sometimes a little difficult to see. Innovations should clearly be related to the world of engineering. Candidates could improve their response by providing a more detailed explanation of the social and economic impact the innovation has made.

Conclusion and Recommendations

LO1 and LO2 were often well attempted, but the level of detail was sometimes a little insufficient to access the higher mark bands. Candidates could explore products, services and sectors in more depth.

LO3 requires candidates to look at qualifications to access job opportunities, and progression routes. The Engineering Council was often well covered using information from the EC website. Please note that candidates should be encouraged to present information that is referenced, or in their own words.

For LO4 the innovations need to be relevant to the field of engineering, and candidates need to identify the social/economic impact the innovation has made.

R103 Sustainable engineering

General Comments:

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In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

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Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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Comments on Individual Learning Outcomes:

LO.1 (a and b)
Candidates were clearly able to identify materials and components from engineered products but sometimes focused more on the properties of these materials rather than the implications of their use for sustainability and the environment. Some candidates had touched upon the use of finite raw materials, and had also tried to reference the 6Rs in their analysis.

Candidates should focus on the application of the materials and components with reference to sustainability and environmental impact in order to access the full range of mark bands.

LO.2
Candidates made a good attempt at this LO by considering design features such as the energy usage during operation of products or domestic appliances, energy used for manufacture and how it could be maintained. Other factors candidates could consider are materials selection, product life cycle, and design for obsolescence.
Although candidates often identified a range of relevant points, the depth of coverage relating to the design process requires more detail. It is required for this LO that the impact on the design process is considered.
Candidates are required for this LO to draw upon skills/knowledge/understanding from other units in the specification and it would be useful if this was made explicit.

LO.3
Candidates made good attempt at this LO identifying local labour markets, transport costs and their effect on carbon foot print. Again, while a range of excellent considerations were identified the depth of coverage was sometimes a little weak.

Conclusion and Recommendations

Candidates often focused on domestic appliances, such as the washing machine, using this effectively to investigate each LO. It is perfectly acceptable to focus this unit on any other engineered product.

Although candidates were often able to identify the key points to access each LO, the depth of coverage was sometimes insufficient to access the higher mark bands as noted above.

R104 Optimising performance in engineering systems and products

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

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Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1a
This LO was often well covered albeit sometimes not explicitly. It was evident in most candidates' work that they understood how systems and products require maintenance, but not always the reasons for this (e.g. why perform maintenance).

LO.1b
This LO was often implicitly covered by candidates. It was evident that all understood the connection between undertaking maintenance and enabling optimum performance of a system or product (e.g. changing oil or air filter, tensioning a belt etc). The link between reasons for maintenance and optimisation of performance needs to be clearly made.

LO.2
Most candidates had explained clearly different types of maintenance strategies, and their application. Overall, a well attempted LO.

LO.3
Most candidates had shown – often using a table or with photos – different failure modes of components and the implications of this failure.

LO4
Candidates often presented a clear description with photographs of undertaking maintenance on a mower engine or similar, and in some case also on other systems such an air compressor. The evidence provided by candidates was often detailed. Centres are encouraged to use the witness statement pro-forma supplied with the Live Assessment to record how safely and competently candidates worked, and how much assistance was required. This should be in addition to the evidence provided by the candidate (e.g. both candidate-generated evidence such as photos and also a witness statement are required).
Candidates are also required for this LO to draw upon skills/knowledge/understanding from other units in the specification and it would be useful if this was made explicit.

Conclusion and Recommendations

This unit was generally very well attempted.

LO1 requires a description of the reasons why engineered systems need maintenance, and in LO2 the different types of maintenance strategies available.

For LO3 candidates should investigate the different types of failure mode that can occur. This was generally well attempted and presented.

For LO4, candidates should perform a practical maintenance operation. The evidence supplied was often quite detailed, with photographs and written evidence generated by candidates. This was often corroborated with witness statements supplied by centres. Centres might consider alternative means of providing evidence (e.g. videos of maintenance being performed) or can use the pro-forma witness statement provided with the Live Assessment. Centres, as always, are reminded that witness statements must only be used to corroborate and support candidate-generated evidence, and are not acceptable as a substitute to this.

R105 Design briefs, design specifications and user requirements

General Comments

This was the sixth series for this examination. Due to the number of series that have now been undertaken, it is clear that centres are preparing candidates for the paper more effectively resulting in them being able to access and gain marks on the vast majority of topics covered in the specification. As in previous series, the paper was successful in discriminating across the ability ranges.

As mentioned in previous reports to centres, 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 learners for the examination using the past papers for this examination. This should allow learners to answer the whole paper with sufficient understanding and depth. There are key areas of the specification where candidates' understanding is not as fully developed as it needs to be to access the questions.

As mentioned in previous series, there are still times when candidates are not addressing the command verbs in the questions. 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' some candidates are answering with one-sentence answers which limit their ability to access the full marks available for the question.

Comments on Individual Questions:

Question No. 1

Part 1ai of this question required candidates to list important considerations of a product 'Life Cycle Analysis' (LCA) in order. On the whole, the question was answered well with a large majority of candidates achieving full marks. Where candidates have failed to achieve full marks they had clearly not covered LCA in detail or had simply not given due care and attention to the options given and their logical order of consideration.

In part 1b, candidates were required to give three ways in which new and emerging materials could contribute to a product's lifecycle. This was generally answered well, with most candidates able to give suitable ways in which new or emerging materials could contribute to a products lifecycle. Where candidates lost marks here, general or vague responses were listed that did not give consideration of how 'new and emerging' materials rather than general material selection may have an impact.

In part c of question 1, design for disassembly had to be considered with candidates asked how the ease of disassembly can contribute to sustainable design. Many candidates focused on the requirement for maintenance or repair of the product. This point is valid and provided some excellent responses. In addition, candidates achieving full marks considered how the separation of materials allowed for more effective recycling and disposal of materials at the end of life.

Question No. 2

In question 2ai candidates were asked to give two factors that may inform the development of a design brief. On the whole candidates were able to access marks here by giving valid responses. In some cases however, candidates gave vague or generic responses that struggled

to gain the marks available. Centres and candidates are encouraged to ensure that responses are specific to the question and candidates do not rely on generic responses to gain marks in questions that may require a more detailed or specific response.

Question 2aii required candidates to state one other process in the identify phase of the design cycle. The understanding of the design cycle has been raised in previous series and is still not fully developed within candidates. Lots of candidates were unable to give a valid, additional process that is undertaken within the identify phase of the design cycle which has limited their ability to gain marks here. Some candidates gave processes that occur in different phases of the cycle.

In part iii of question 2, candidates then had to name two other phases of the design cycle. As per the commentary above, many candidates missed out on marks here as they detailed processes carried out within other phases and not actual phase titles as detailed in the specification. Centres are reminded to cover the specification in detail across all areas which should therefore allow candidates to access marks in questions such as this one.

Question 2, part b, asked candidates to give two ways in which market research can be used to update an existing product. On the whole most candidates were able to access marks here but in some cases they failed to action the specific points the question was asking for. Some candidates gave specific examples of market research which, when qualified were valid, but on their own, did not always meet the requirements of the question. Centres should ensure candidates fully read questions and act on the requirements of the specific question.

Part c of question 2 required candidates to describe, using an example, how the function of a new product could be influenced by the target audience. Responses to this question varied greatly with some candidates able to select a specific product, function or feature and describe how the target audience may have informed the design choices behind its development. In some cases however, as per previous questions, candidates relied on more generic answers that although sometimes relevant could at times limit the candidates' ability to gain marks.

Question No. 3

Question number 3a required candidates to give two safety factors that should be considered when designing children's building blocks. Overall, this question was answered well with the vast majority of candidates having a good understanding of safety within the development of child's toys which, was generally applicable to this question. However, in addition to this, candidates on the whole, were able to give responses that were specific to the building blocks with some consideration of how they will be used and the manufacturing process that has created them.

Part b of question 3 required candidates to give two reasons why the building blocks would have been manufactured using plastic moulding. Responses to this question varied but on the whole most candidates were able to achieve some of the marks available in this question. As per the feedback given in previous reports to centres learners are making reference to the associated cost benefit of plastic moulding but do **not** qualify this with the scale of production. Centres are reminded that when candidates consider the cost advantage of plastic moulding they must qualify it by the reduction in cost per unit as the scale of production increases.

Question 3c required candidates to show understanding by assessing their quality of written communication in a discussion question that focused on how the manufacturing process had affected the design of the building blocks.

The quality of answers provided varied dramatically. Where candidates failed to achieve high marks, responses lacked development. Candidates who gave strong responses were able to discuss how plastic moulding has affected the design through material selection, repeatability, quality, accuracy, wall thickness, fillet radii and mould ejection. Some candidates focused on

cost of plastic moulding but did not qualify it by considering the rate or scale of production which led to some general responses that could not access the higher marks. In some cases, points were repeated rather than developed and many candidates did not write in extended prose therefore failing to meet the requirement of the extended written response asked for in this type of question. Centres are reminded to ensure they cover the full scope of the specification in depth to ensure candidates achieve maximum marks. As mentioned previously, centres are reminded to develop candidates' ability to write extended responses. Some responses were written in bullet point format and, although some excellent points were made, candidates could not achieve higher marks as they are being assessed on their ability to write extended prose and not just their knowledge of the topic in the question.

Question No. 4

Question 4a required candidates to indicate which components were 'standard' or 'pre-manufactured' from a list of examples. The majority of candidates were able to select the appropriate 'standard' or 'pre-manufactured' components but in some cases it was clear that candidates did not know or understand the difference between a 'standard' or 'pre-manufactured' component.

The development of understanding related to pre-manufactured components was further explored in part b of question 4. Candidates were asked to give three reasons why pre-manufactured components may be used in production. Some of the misunderstanding evidenced in part a of question 4 was also apparent in this part of the question. Candidates in some cases were referring to reasons that would be more associated with 'standard' rather than 'pre-manufactured' components. Those candidates that accessed the vast majority of marks were able to outline the time-savings later in production or ability to guarantee quality from reputable, experienced suppliers. As per responses in previous questions, there is a common response from candidates related to saving money or reducing costs e.g. cheap. This is not always the case and in ALL cases needs to be qualified to gain marks.

Part c of question 4 required candidates to explain how the scale of manufacture can affect the cost of production. Where candidates were able to access most or all of the marks in this question they were able to provide responses that demonstrated understanding of how the cost per component was reduced as scale of manufacture rose despite the additional requirements for labour or machinery. Where candidates did not gain marks they failed to demonstrate this understanding.

Question No. 5

Question 5a asked candidates to state two ways the working environment has influenced the design of a kettle. This question generated a variety of responses with a mix of quality. In some cases, candidates gave responses that were general, vague or highlighted key design features of the kettle that were not directly related to the working environment. Those candidates that were able to access full marks were able to give design considerations or features that would be included in a kettle as a direct result of its working environment and associated conditions.

Part b of question 5 was generally answered with valid responses that achieved marks and allowed candidates to achieve some, if not all, of the marks. Candidates were able to pick up on key aesthetic changes such as colour or material that would allow designers to modify the aesthetic appearance of the kettle. Responses related to shape were valid if they were qualified by a specific feature or detail associated with the kettle.

Question 5, part c, required candidates to consider the production of virtual or physical prototypes and how they can be used to validate a product. Part ci asked candidates to give two methods that a designer may use to produce a prototype. Generally, this question was answered

well with most candidates able to give methods that a designer may use. Responses showed a good understanding of the methods available for prototype production.

In question 5, part cii, candidates were required to describe how a physical prototype can be used to validate a product. As per part i of this question, most candidates were able to describe multiple ways that a physical prototype can validate a product. Most candidates were able to highlight the advantages of a physical prototype over a virtual one within these responses which, allowed for accessible marks within the question.

Question No. 6

Question 6ai required candidates to give an example of an iconic product. The responses given to this question varied greatly with lots of examples given that could be deemed as 'popular' but not necessarily 'iconic.' In many cases candidates referred to products they were familiar with but these products would not necessarily be recognised as iconic designs. In some cases it was clear that candidates had not covered the specification in detail or had limited delivery related to 'iconic' products. Centres are reminded that they should develop a detailed understanding of a range of iconic products that candidates can use to inform their responses within questions such as this one.

Part aii of question 6, required candidates to state two reasons why the product that they have chosen became iconic. Although candidates were recognised for valid responses here, regardless of their response to part ai of this question, some responses struggled to gain marks due to the lack of understanding of 'iconic' products. Some generic responses were given that at times failed to gain marks. Those candidates that gained maximum marks here were able to give specific reasons why a valid iconic product gained recognition and due to its design, gained an iconic status.

Part b of question 6 asked candidates to explain why designers may use iconic products as inspiration when developing new designs. Again, it was tangible where candidates had a developed understanding of iconic products and how these have influenced future designs across a range of future products. Candidates who had this developed knowledge were able to access the maximum marks where as candidates without this developed knowledge gave general or vague responses.

Question 6 part c asked candidates to explain why a designer may apply for a patent. On the whole candidates were able to access the marks available within this question and demonstrated a solid understanding of the reasons why a designer may apply for a patent.

Part d of question 6 required candidates to state the meaning of a 'trademark.' As per part c of this question, candidates on the whole gave valid responses. Where responses did not gain the marks available here, candidates were not explicit about the meaning of a 'trademark' and may instead be referring to copyright or to patents. Centres are reminded to ensure candidates can explicitly differentiate between patents, copyright and trademarks as these questions require a specific understanding of the differences to gain the full marks.

R106 Product analysis and research

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

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Comments on Individual Learning Outcomes:

LO.1
Candidates often answered this LO well by identifying commercial production methods, end of life consideration and also legislative requirements such as CE and BS Kite marking. Materials, processes and commercial considerations etc, however, were covered as 'stand alone' with no impact on the product or item being examined. It would be more beneficial for this to be related to the product being investigated (e.g. the drill pump). It should be noted that the function and operation of products is not explicitly required for this LO, which were sometimes covered by candidates.

LO.2
Generally, this was well attempted with candidates demonstrating a good range of research skills. Sometimes the focus was a little too much on the research skills themselves being used, and rather what they were being used to research. The strengths and weaknesses were sometimes not clearly presented (and sometimes not evident at all), and so centres should encourage candidates to concentrate on this.

LO.3a and b
This LO was often very well attempted. Most candidates could provide a good analysis of a product through disassembly. Candidates are also required to make a clear link back to Unit R105. Where candidates failed to address this LO fully was for inadequate details of each stage of disassembly, safe use of tools and safe working etc. One way in which this can be achieved is using an annotated photographic diary supported with a witness statement.

Conclusion and Recommendations

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.

In LO3 candidates could evidence disassembly through annotated photographic evidence or similar. This should show all stages of the disassembly process, and could highlight materials and manufacturing processes along with maintenance. A witness statement, or similar, should be used to corroborate how safely and independently candidates worked and if they used the appropriate tools. Centres could 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. Centres are reminded that witness statements must only be used to corroborate and support candidate-generated evidence, and are not acceptable as a substitute for this.

R107 Developing and presenting engineering designs

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome should not be used for others. This is also the case for work that overlaps more than one unit within the qualification.

Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
LO1 was well attempted. Most candidates were able to produce good quality 2D and 3D sketches applying techniques including shading and rendering. It should be noted that both 2D and 3D sketches are required, and candidates should be encouraged to generate several initial design ideas. Labelling was good, and in most cases there was evidence of both labelling and annotation. 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 candidates in the commentary on the URS or using a witness statement in future submissions.

LO.2
There was clear evidence that candidates had attempted isometric and oblique drawings, or third angle projection 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 clearly evidenced knowledge from other units e.g. R106. Although the intention for this LO is for candidates to produce engineering drawings using hand-drawing techniques, the use of CAD to produce third-angle engineering drawings is acceptable. Again, please note that both 2D and 3D engineering drawings are required.

LO.3
This LO was often well attempted. There was often excellent 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. Although it is not required that CAD drawings be exactly to British Standards, they should include dimensions, surface finishes etc. and be detailed enough to enable the item to be manufactured. Where candidates failed to access this LO fully was for poor detail on their CAD drawings making them insufficient in detail to be able to manufacture the item.

Conclusion and Recommendations

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 tutor assistance or otherwise, and LO3 where candidates may give a presentation to show their final design ideas.

LO1 was well attempted. There was good evidence of sketching, appropriate annotation and detailing, and the use of computers to produce augmentation. Please note that both 2D and 3D sketches are required, and encourage candidates to produce a wider range of initial design ideas.

LO2 requires candidates to present designs in 2D and 3D using formal drawing techniques. This was well attempted by many centres, although some centres could develop these skills further with candidates. Both 2D and 3D engineering drawings are required which should ideally be hand-drawn although those produced using CAD is acceptable.

For LO3 CAD was often very well attempted. Often final presentations lacked sufficient detail to enable the product to be successfully made.

R108 3D design realisation

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome should not be used for others. This is also the case for work that overlaps more than one unit within the qualification.

Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1a and b
Candidates often provided an excellent interpretation of a product specification. Where candidates failed to access the higher mark bands the interpretation was too weak or too generic (e.g. it should include user requirements, dimensions, weights, finishes etc.).
Most candidates produced a detailed plan along with Gantt chart for the making of a prototype. This was often sufficiently detailed. Some candidates, however, produced a weak plan with little reference to tools, equipment and materials, and so failed to access the higher bands. Centres could provide candidates with a tabular planning template for them to complete.

LO.2
There was evidence of candidates producing risk assessments, 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 in the form of annotated photographs, which was backed up by a witness statement. Some candidates failed to address these important points relating to health and safety however.

LO.3
There was often 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. These should clearly show the candidate number. There was also evidence of materials selection, however this could be made more explicit. As usual, witness statements can be used to support and corroborate candidate-generated evidence.

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

Conclusion and Recommendations

In LO1 interpretation of the specification was often good, but sometimes too generic and lacking in detail such as user requirements, dimensions, weights, finishes etc. Plans were often quite detailed, and a Gantt chart produced. Centres could use a planning template.

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 which is of concern.

For 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. Candidates should be encouraged to show clearly each step of the making process, culminating in showing the final item.

LO4 requires evaluation of the finished item against the plan and specification, and also reflection on personal performance, strengths and weaknesses. This was generally well attempted, but sometimes did not compare the finished items against the required product specification and making plan.

Centres are reminded that witness statements can only be used to corroborate and support candidate-generated evidence, and are not acceptable as a sole substitute for this.

R109 Engineering materials, processes and production

General Comments:

Most candidates attempted all of the questions on the paper but, in a number of cases, knowledge of some sections of the specification appeared to be quite limited. This was made apparent by an increase in the number of questions to which no response was given.

Responses to questions relating to basic engineering materials and processes were disappointing in the main. Knowledge of digital technologies shows some improvement, but understanding of their application was varied across this cohort of candidates. Specific examples and details of these points are given later in this report.

In a number of cases it was apparent that candidates had not read questions carefully enough before giving their answers, resulting in a loss of marks. In questions where candidates are asked to describe or explain processes or procedures, it should be noted that justified responses need to be presented in order to gain the higher marks available. One-word or overly simplistic answers are not suitable responses to this type of question.

Comments on Individual Questions:

Question No.

1(a)(i) Most candidates scored well on this question, but a number showed some confusion and appeared to choose examples from the list at random, and marks from zero to full marks were awarded.

1(a)(ii) This question was less well answered and most candidates scored only one of the two marks available. Carbon fibre was the most frequently seen correct answer, with GRP a close second, but High Speed Steel and Urea-formaldehyde also appeared in a significant number of cases.

1(a)(iii) Most candidates correctly gave Urea-formaldehyde or Polyester resin as a thermosetting plastic, but a number seemed to think that any of the plastics materials in the list were appropriate answers, with ABS and HIPS being quite commonly seen.

1(a)(iv) This question was quite well answered and only a small number of candidates failed to score marks on it. Where incorrect responses were given, it seemed that they had been selected by guesswork, as composites, plastics and also ferrous metals were all seen on a number of occasions.

1(b) Responses to this question were disappointing and a significant number of candidates failed to score any marks at all. In most cases features of thermoplastic materials were simply stated, with no reference to reasons for using them instead of metals. One-word responses were very common, and the weaker candidates merely suggested that thermoplastics were ‘cheap’ and ‘recyclable’.

2(a)(i) The majority of candidates scored full marks on this question. Conductivity and ductility were the most frequently seen properties of copper, although malleability and corrosion resistance were equally acceptable.

2(a)(ii) This question was generally not well answered and only the more able candidates scored two marks or more on it. In many cases, candidates did not seem to fully appreciate the actual function of the overhead cables, and responses making reference to cables catching fire or being unable to carry the amount of current were seen. The only acceptable response that was given with any frequency was the fact that copper is an expensive material, but the question of weight was rarely mentioned.

2(b) Most candidates scored at least one of the two marks available for this question, with powder and sheet being the two most commonly seen forms of engineering materials. Liquid was also an acceptable response to the question, but in a number of cases candidates had suggested gas as a material form, this being taken as a consumable, not a material.

2(c) Knowledge of non-destructive testing was very mixed and a number of candidates did not offer a response to this question. Explanations were generally quite weak with some being little more than an expansion of the question content. Where more detail was given, this was usually in the form of references to X-ray testing for cracks or the use of penetrating dyes. Only a limited number of higher achieving candidates scored the full three marks for the question with a detailed and justified explanation.

3(a) Responses to this question were generally disappointing, with many candidates scoring one mark or less, and a significant number not attempting it. Only the higher achieving candidates referred to the use of flux in the process, and any references to heat were generally very vague. Where marks were scored by the lower achieving candidates, these were commonly as a result of basic references to assembling the joint and then allowing the finished article to cool, albeit from an unspecified temperature.

3(b)(i) Most candidates were able to give at least one example of a joining process that did not use heat, riveting and the use of nuts and bolts being quite common. Where marks were lost, this was normally due to candidates giving inappropriate responses, such as welding and soldering, or by making simplistic reference to ‘glue’, which needed to be more specific in this application.

3(b)(ii) This question was quite well answered, with most candidates scoring two marks or more. In some cases descriptions tended to be somewhat disjointed, and stages in the process were either missed out or misplaced. Examples of this were the tapping of holes for using self-tapping screws, and the use of a rivet gun without drilling holes.

4(a) Responses to this question were very varied and marks from zero to the full five marks were awarded across the cohort. Only stage one was correctly named ‘facing’ with any regularity and very few candidates realised that stage four was ‘taper turning’ and not ‘chamfering’. It was disappointing to see so few candidates having detailed knowledge of the processes carried out here.

4(b)(i) Knowledge of heat treatment processes appeared to be quite limited, and many candidates confused case hardening with hardening and tempering. Marks were awarded where candidates had mentioned the required temperature or colour the mild steel needed to be heated to, but in almost all cases the peg was then immediately quenched in oil or water. Very few candidates referred to the use of a carbon rich compound to carburise the surface of the steel, or to the peg being heated in an oven with a carbon rich atmosphere for the same purpose.

4(b)(ii) As with part (i), it was apparent that knowledge of heat treatment processes was quite limited. Only the more able candidates named two heat treatment processes correctly, whilst the weaker candidates either did not attempt the question, or gave the names of any process that used heat, such as welding, forging and casting.

5(a) Responses to this question were again very varied, with the whole range of marks being awarded. Good responses related to machining centres effectively doing the job of CNC lathes and CNC milling machines in one unit, this often being justified by the fact that products do not have to be moved between machines. Where marks were lost, this was normally as a result of candidates giving benefits of CNC machines compared with conventional machines, although some candidates thought that a CNC machining centre was a place where CNC machines were stored and/or sold.

5(b) This question was generally well answered, with most candidates being able to give at least one application of lasers in engineering production. The most popular examples were laser cutting and laser sintering, although the uses in engraving, alignment and measurement were also quite commonly seen.

5(c) Very few candidates gave sufficiently detailed explanations to score more than two marks on this question. Most responses included reference to the use of appropriate computer software to produce a 3D image of the product, but detail of the actual printing process was rather more limited. Only the more able candidates included reference to the slicing of the 3D image into layers which were then built up into a 3D prototype on the 3D printer.

6(a) Most candidates that attempted this question showed a reasonable awareness of digital communications, but were rarely able to give clear descriptions of their application. In many cases examples of the technologies used were not given, whereas in other cases the technologies were named without describing their use. The most frequently seen technologies were the Internet and emails, and some candidates also made reference to video conferencing, but descriptions of use were generally weak, and two marks out of the four available for the question was the norm.

6(b)* This extended response question was attempted by most candidates, largely with reasonable success, and marks across the full range were seen. The most frequently discussed business issues relating to global manufacturing were those of cheaper labour and availability of resources in other countries. Some higher achieving candidates showed a broader understanding of the business benefits by also making reference to currency issues and proximity of markets.

The candidate's Quality of Written Communication (QWC) was assessed in this question, and marks were awarded for well written answers, despite technical content sometimes being somewhat limited.

R110 Preparing and planning for manufacture

General Comments:

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Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

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Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1a
This LO requires interpreting 2D and 3D drawings and identifying all relevant details required to make a pre-production product. Candidates could evidence this through a written interpretation of a supplied drawing (e.g. by annotating the drawing). It would help with moderation for centres to supply the drawing that candidates have used if this is not the case.

LO.1b
For this part of the LO candidates are required to produce a production plan. Where done, this was often quite detailed. In a few cases, only basic plans had been produced. The plan should identify sequence of operations, tools, equipment, manufacturing processes, health and safety requirements and quality control checks. Centres could provide candidates with a planning template with headings for them to complete.

LO.2a
This LO requires candidates to demonstrate the safe use of hand and machining practices to make an item using the production plan. Please note that the intention here is to use hand tools, and not CNC machining processes. Annotated photographic evidence is an effective way to show each step of the process. In some cases, only finished items were shown meaning that it was difficult to assess the process. This LO can be supported using a witness statement.

LO2b
This LO requires candidates to review the quality of the component made using appropriate quality control checks. Again, documentary evidence supported by photos and a witness statement here are all reliable ways of demonstrating this. Dimensions etc. should be compared back to the requirements of the initial drawings.

LO3
This LO requires candidates to reflect on the production plan make modification appropriate to an increased scale of production. It was evident that some candidates simply said the use of a CNC machine was sufficient, but attention should also be given to other implications such as batch operations for certain operations (e.g. cutting to length, facing off, drilling a hole etc.), sequencing of operations, materials supply etc. to give a more comprehensive and convincing answer.

Conclusion and Recommendations

For LO1 and LO2 both require candidates to demonstrate independent working, and also working safely and competently. Candidate-generated evident supported using a witness statement or other means is an effective way to show this for both of these LOs.

In LO3 candidates could give a more reasoned answer as to how increased-scale production can be achieved rather than a simply using a CNC machine.

Centres are reminded that witness statements must only be used to corroborate and support candidate-generated evidence, and are not acceptable as substitute for this evidence.

R111 Computer aided manufacturing

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome should not be used for others. This is also the case for work that overlaps more than one unit within the qualification.

Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
Most candidates attempted this LO and were able to provide plans for the production of components using a CNC machine. The plans sometimes required more detail in order to access the higher mark bands. Centres should refer to LO1 in the unit specification for details of what the plan should include, and could supply candidates with a blank planning template with headings for them to complete.

LO.2
LO2 requires candidates to interpret a CNC program and to demonstrate program operations. There was often limited evidence of this interpretation thereby restricting access to the higher mark bands. Evidence could include annotated G code (or similar), or a set of annotated screen shots showing how the CNC programme operates.

LO.3a, b and c
This LO requires candidates to set up and use a CNC machine to manufacture components. There was often good evidence of this taking place, but in some cases only the final item was shown. One way in which to demonstrate this is by annotated photographic evidence supported by a witness statement showing all stages of the CNC process (such as setting up the machine, loading the material, performing programming and machining operations and the final items produced).
This LO also requires candidates to make a comparison between manual and CNC produced components, and one effective way seen of doing this was to compare components made in Unit R110 with those in R111.

LO4
LO4 requires candidates to explore the wider application of computer controlled processes. Most candidates could identify suitable processes with examples and so access the full range of mark bands.

Conclusion and Recommendations

There was good evidence of candidates attempting this unit.

For LO1 (planning) candidates could provide more detail, considering factors such as timings, operations, materials, health and safety and quality checks.

In LO2 the interpretations were sometimes a little weak, and could be shown using annotated screen shots.

For LO3 further evidence of each stage of setting and operating the CNC machine should be provided and corroborated, for example, using a witness statement.

In LO4 the exploration of computer controlled processes was well addressed by most candidates.

Centres are reminded that a witness statement or similar is an effective way in which to support and corroborate LO2 and LO3 in addition to evidence provided by the candidate. A proforma witness statement is included with the Live Assessment, and guidance on its use available from the OCR website.

R112 Quality control of engineered products

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

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Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

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Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
LO1 requires candidates to describe, using suitably relevant examples, the reasons for implementing quality control in production. This was often well attempted.

LO.2a, and b
LO2 requires comprehensive quality control checks to be performed during stages of production. One way of demonstrating this is for candidates to perform actual quality control checks using measuring equipment. An effective way for candidates to demonstrate this is in the form of annotated photographs supported by a witness statement. Measurements taken can be tabulated and compared against expected values. Centres are encouraged to provide candidates with the opportunity to undertake a range of different quality checks including visual and measurements (e.g. using a rule, Vernier caliper, micrometre, gap gauge etc.). This practical activity could be linked to quality checking work produced in other units e.g. R110 and R111.

LO.3
This LO requires a description of the application of modern technologies used in quality control. While there was some good evidence of this, some candidates misinterpreted this and provided a description of the application of computers in manufacturing rather than their allocation in quality control. Examples could include computer visual inspection, co-ordinate measurement and automated test equipment (ATE) etc.

LO.4
For LO4 candidates are required to produce a description of the categories of waste and methods used to reduce waste in lean manufacturing. Most candidates could identify each area of TIMWOOD and explore them in detail. Some were able to extend this by exploring Design for Manufacturing Assembly (DFMA).

Conclusion and Recommendations

LO1 was often well attempted, with the reasons for implementing quality well explained.

LO2 required further evidence of specific quality control checks being performed, and would benefit from the comparison of checked with expected values. Centres could get candidates to use a wider range of QC techniques.

LO3 was often well attempted, but was misinterpreted in some cases as highlighted as it requires a description of the use of modern technologies in quality control, and not manufacturing.

LO4 was generally well attempted with candidates identifying aspects of TIMWOOD, and DFMA.

Centres are reminded that, where used, a witness statement or similar provides additional to evidence provided by the candidate. A proforma for the witness statement is included with the Live Assessment for LO2.

R113 Electronic Principles

General comments

A high proportion of candidates attempted all six questions.

In some cases candidates had clearly failed to read the question fully and went on to provide a response that was not actually relevant to the question. Candidates should be advised to read the complete question before attempting a response.

Specific Comments

Question One

(a) Generally well answered with the two symbols being well known.

(b) The statement 'Electro-Motive Force' despite being a fundamental unit within electronic principles was not well known with a variety of incorrect responses being provided.

(c) The formula for calculating resistance R = V/I was well known with a majority of candidates achieving maximum marks.

(d) Generally well answered with the concept of solar power being understood and a majority of candidates achieving high marks.

(e) Generally well answered with the advantages of using re-chargable batteries as compared to non-rechargable batteries being well known.

Question Two

(a) Many candidates seemed to have little or no understanding of the preferred E12 series resistor code.

(b) Generally well answered with the concept of tolerance being understood and a majority of candidates achieving high marks.

(c)(i) There was evidence that a number of candidates did not know how to draw a Darlington Pair diagram or give a reasonable explanation of its function.

(c)(ii) Generally well answered with a wide range of correct responses being given.

Question Three

(a) The term 'latching switch' was not well known with a high proportion of candidates not giving an example of its use.

(b) The circuit diagram showing a DPDT switch controlling the direction of rotation of a DC motor was not well known.

(c)(i) The meaning of the term 'Shape Memory Alloy' was generally well known.

(c)(ii) Most candidates could not name a Shape Memory Alloy.

Question Four

(a)(i) Generally well answered with a number of candidates achieving maximum marks.

(a)(ii) In the main candidates seemed to have little or no understanding of how to complete the truth table from a given circuit diagram.

(b) Generally well answered with a majority of candidates correctly stating four types of fault that are often found when visual inspection of a completed circuit board takes place.

Question Five

(a) The term 'Surface Mount Technology' was not well known with a high proportion of candidates giving confused and incorrect responses.

(b) Mixed responses seen to this question with some candidates giving imaginary benefits and drawbacks for the use of surface mounted components in commercial use.

(c) Generally well answered with a majority of candidates correctly ticking the two correct statements for quality assurance methods used during the production of printed circuit boards.

Question Six

(a)(i) The formula for calculating power was well known with a majority of candidates achieving maximum marks.

(a)(ii) A number of candidates are still confused that energy W = Pt. Lots of candidates confused the unit of energy even though it was given in the question.

(b)* A high proportion of candidates seemed to have not read the question carefully enough. The question states 'Discuss the **applications** of solid core cables, multi-core cables and ribbon cables but many responses did not discuss **the applications** of these three types of cable.

R114 Simulate, construct and test electronic circuits

General Comments:

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation. In general, the correct samples requested were submitted and where not centres were contacted.

Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome should not be used for others. This is also the case for work that overlaps more than one unit within the qualification.

Where photographs are presented as evidence centres should ensure that these are annotated to indicate what they are showing and also include the candidate number.

There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
There was clear evidence of candidates being able to produce a circuit schematic diagram, and the circuit being simulated. In some cases, there was limited evidence of simulation, or of any circuit modification through testing.
This LO also requires candidates to demonstrate how they can use software to produce a PCB layout – to include both track and component views.
This was generally well attempted, but marks seem to have been given for simulation in some cases where this was not clearly evident. Photographs and annotated screenshots are an effective way to illustrate simulation and also show PCB layout production.

LO.2a, b and c
This LO requires candidates to safely manufacture a blank PCB and to populate the PCB using suitable components. While it was often clear that candidates had done this, their presentations did not clearly show some aspects such as health and safety, testing of the constructed PCB and the quality of construction. This might be achieved by candidates including further annotated photos (e.g. a photo diary) with commentary, and also by the inclusion of a witness statement or similar. A proforma witness statement is included with the Live Assessment which can be used to corroborate and support candidate evidence.

LO.3
There was some evidence of testing, but in many cases, this was a set of measurements. Sometimes it was simply a generic photograph of a piece of test equipment (e.g. multimeter) and a statement that testing had been undertaken which is inadequate. There was also evidence of only visual testing being performed. Again, this LO can be supported with a witness statement. Candidates could provide better evidence to meet this LO, such as annotated photos and records of tests and measurements performed. This should include measurements taken against those that are expected (e.g. voltage, current, logic or waveform readings).

Conclusion and Recommendations

LO1 requires candidates to clearly demonstrate producing or reproducing a circuit diagram using schematic circuit software, performing a simulation, modifying the circuit in some way and also producing a PCB layout. Annotated screenshots or photographs are effective ways in which this could be shown.

For LO2, learners are required to safely manufacture a blank PCB and populate their PCB with components. Again, annotated step-by-step photographic evidence supported by a witness statement is a very effective way to achieve this. Health and safety is also required to be shown (which could be a risk assessment).

In LO3 candidates are required test their completed PCB/circuit. Again, photographic evidence of testing taking place, with an accurate record of measurements alongside a witness statement could be a secure method of demonstrating this. Actual values should be compared against those expected.

Centres are reminded that witness statements must only be used to corroborate and support candidate-generated evidence, and are not acceptable as a sole substitute.

R115 Engineering applications of computers

General Comments:

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Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

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There was some evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Centres are encouraged to use the witness statements included with the Live Assessments to support and corroborate candidate-generated evidence. They can also be used to support other Learning Outcomes as appropriate.

Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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Comments on Individual Learning Outcomes:

LO.1
For LO1 candidates are required to demonstrate some understanding of how computers are used within engineering design, manufacture and process control. They should also draw upon skills/knowledge/understanding from other units in the specification. This was often well attempted with examples including computer aided design (CAD), computer aided manufacturing (CAM) and computerised process control. Where candidates failed to address all three areas limited their access to the mark bands.

LO.2
For this LO candidates are required to demonstrate understanding of Human Machine Interface (HMI) and expert systems in maintenance. While these were often well described, candidates did not always access and interpret data from a system, and make recommendations for corrective actions. This LO therefore requires access to maintenance data, which centres will be required to source. Examples include engine management system fault codes, machine fault codes and other fault code data. Candidate evidence for this LO could be provided in the form of annotated photographs supported by a witness statement.

LO.3a and b
For this LO candidates are required to explain how computers exchange data during manufacturing operations, and also how they communicate and exchange data during maintenance operations. In some cases, both aspects of communication were not apparent, only one. They are also required to explain how production data is used in maintenance operations, and how hand-held devices are used in both manufacturing and maintenance systems. Candidates are required to address all of these points to access marks in the high bands.

Conclusion and Recommendations

LO1 was generally well attempted, although it is required to address all three areas: design, manufacturing and process control.

In LO2 further evidence was sometimes required of the interrogation of system data (to include interpretation of the data and suggesting corrective actions). Candidates will require access to suitable data to be able to access this LO.

For LO3 it should be noted that both the use of data, and data interchange in both manufacturing and maintenance is required.

Centres are reminded that witness statements must only be used to corroborate and support candidate-generated evidence, and are not acceptable as a sole substitute.

R116 Process control systems

General Comments:

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Most centres had included, for each candidate, a completed Unit Recording Sheet (URS). There were a few cases where the URS had not been submitted meaning that this had to be requested by the moderator to enable moderation to take place.

In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases, work was referred to centres to make or confirm a correction. There were also some cases where marks had been incorrectly entered online to OCR Interchange. These were identified during moderation and centres notified.

Standard of assessment by centres was generally consistent for this series, however where it was not assessment tended to be somewhat generous or variable. Specific reasons for this are highlighted in the separate Report to Centre for that unit.

Teacher commentary on the URS was generally useful where provided, but some instances would benefit from the inclusion of further commentary on the URS and candidate work in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each candidate's work is being accepted against each learning outcome.

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Witness statements can support and corroborate how safely and competently candidates worked, and how much assistance was required i.e. level of independence.

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

Comments on Individual Learning Outcomes:

LO.1
For LO1 candidates are required to demonstrate understanding of microprocessor/microcontroller layouts in products or systems. This could be done using a range of examples and include input, output and control devices (e.g. for a washing machine, CNC machine etc.). Operation is also required to be explained. This was generally well attempted however some elements were sometimes missing. Some candidates also only provided one example, and so should be encourages to provide at least two or three examples.

LO.2a and b
In this LO candidates are required design, develop and simulate a control system. This was generally well attempted but evidence was difficult to follow. Evidence could include annotated programs, annotated screen shots showing programming, photographic evidence of hardware implementation etc. This could be supported using a witness statement. While it was apparent that candidates were able to develop and program a control system, the evidence did not always do this full justice.

LO.3
For LO3 candidates are required to develop a test plan and to test their system using this plan. They are then required to suggest system refinements based upon outcomes of this testing. This was generally well attempted, however the evidence provided was often unclear as to how the system had been tested. One way of providing this would a tabulated grid showing a series of tests to be undertaken, expected results and actual results of testing. Again, this LO can be supported by a witness statement if required.

Conclusion and Recommendations

LO1 was generally well attempted but sometimes parts were missing or basic. Candidates could provide more examples, e.g. two or three different systems where a microcontroller/microprocessor is used.

LO2 was often very well attempted however the evidence provided by candidates was difficult to follow and did not do their work justice. Candidates need to clearly show how they have programmed the control system, how the final software has been loaded to the system, and how the system is operated.

In LO3 there was some evidence of testing but the outcomes of this was at times unclear. A table of tests to be performed along with expected and actual outcomes could be one way to address this. Refinements of the system are also required as a result of testing.

Centres are reminded that witness statements must only be used to corroborate and support candidate evidence, and are not acceptable as a sole substitute.

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