OCR
Oxford Cambridge and RSA

Cambridge Nationals

Engineering

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

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

OCR Report to Centres January 2017

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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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R101 Engineering Principles

General Comments:

Although most candidates attempted all of the questions on the paper, there were exceptions, particularly question 4(a) where there was a particularly high number of incidences recorded of candidates omitting to answer, this was also noted to a lesser extent on questions 2(b)(i) and 5(a). For each of these questions, candidates were required to annotate the diagram. Generally throughout the exam paper, there was some evidence that candidates had not read questions carefully enough before answering. It is 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 however, candidates demonstrated little recognition and knowledge of pneumatic systems and components in this paper.

Comments on Individual Questions:

1(a)(i) Most candidates achieved full marks for this part correctly matching the terms.

1(a)(ii) & (iii) Candidates did not necessarily relate their responses to mechanical sources, or relevant applications.

1(b)(i) Some candidates correctly applied knowledge of workshop tools and related this with specific examples, where as other candidates gave very basic responses of electrical to kinetic conversion.

1(b)(ii) Very few candidates gave examples of electro-mechanical applications in the context of the examples within the specification, however marking allowed benefit of doubt for many of the examples given, where this could be applied.

2(a)(i) – (iii) Candidates across the ability ranges gave correct responses, demonstrating knowledge of levers and the correct application of levers.

2(b)(i) Candidates were required to draw an arrow on Fig. 2 to show the direction of travel for the larger gear, gear A . The majority of candidates that did give an answer, answered correctly but a number of candidates did not provide any response.

2(b) (ii), 2(c) The majority of candidates answered these parts incorrectly or gave vague responses. Higher achieving candidates performed better on these parts.

3(a) Candidates performed well on this calculation question with the majority of achieving the two available marks.

3(b) Candidates performed very well, correctly drawing a parallel circuit. Those candidates who incorrectly drew a series circuit achieved one mark for using all of the components.

3(c)(i) &(ii) These two questions proved to be difficult for candidates as the majority were unable to correctly relate theory of Ohm's law to the physical effect on the lamps.

3(d) Higher achieving candidates performed better to correctly calculate the resistance.

3(e) Candidates performed well with most candidates being awarded the full 2 marks.

4(a)(i) – (ii) These questions were very poorly answered by all but a few candidates. Candidates were unable to demonstrate knowledge of the pneumatic components or their application. A number of candidates did not attempt question 4(a)(i) where candidates were required to label the component with the two correct labels.

4(a)(iii)& (iv) Very few candidates correctly named the uni-directional flow valve nor were candidates able to describe the operation. Marks were awarded to part (iii) where the operation of other components within the circuit was correctly described.

4(b) Higher achieving candidates were able to correctly use the formula to perform the calculation. Candidates were required to use π as 3.14 to be able to correctly complete the calculation. Some candidates lost marks due to the incorrect placement of the decimal in their calculation.

5(a) Candidate were required to draw on the diagram in Fig. 5. For those who attempted the question, most candidates achieved at least one of the available 3 marks for completing the pneumatic circuit.

5(b) Many candidates were unable to communicate a logical applied application using the list of components. Generally, candidates were awarded marks where a feasible use of two or more of the components was given in their answers.

5(c) Candidates performed very well for this part giving an appropriate example of a hydraulic application.

5(d) Candidates performed less well in their knowledge of applying pneumatic applications. Marks were awarded for a feasible description of pneumatics in use.

6(a) The correct answer here was 'Kinetic energy is converted to **mechanical** energy, which is then converted to **electrical** energy.' Few candidates were able to provide a correct response.

6(b) Higher achieving candidates were able to correctly relate Direct Current flow and the use of batteries.

6(c)* Most candidates attempted this question, with most candidates achieving 2 or more marks. Lower achieving candidate responses were limited to uses of wind turbines and incorrect statements about some disadvantages of using wind turbines. Higher attaining candidates made links to fossil fuels used in energy production utilising kinetic forces, and made relative comparisons.

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

R105 Design briefs, design specifications and user requirements

General Comments

This was the fifth series for this examination. The maturity of the paper is now noticeable as candidates are increasingly able to successfully access the paper. 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 students for the examination using the past papers for this examination. This should allow students 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 above, there are still times when candidates are not addressing the command verbs in the questions. At times it is clear that students are not always answering questions in the style expected of the command verb. For example; when a question command verb is 'explain' or 'describe' candidates are answering with one-sentence answers which limits 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 identify common symbols that would appear on products. 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 did not know the CE mark.

In part 1aii, candidates were required to give one reason, other than safety, why signs and symbols are applied to products. This was generally answered well with most candidates able to give suitable reasons for adding symbols to products. In some cases however, candidates may not have paid full attention to the question and gave responses related to safety.

In 1b, candidates had to state two ways that designers can make sure products are safe to use. Overall this question was answered well with most candidates able to relate to testing in their answers. Where candidates lost marks, they generally repeated an answer or were only able to give one specific response.

Question 1c required candidates to explain why it is important for manufacturers to ensure that products are safe. This was answered well with candidates clearly grasping how safety issues in products may cause harm to customers and therefore create financial or legal problems for companies. Where candidates missed marks it was usually due to a lack of extended response and one word or one-sentence responses.

Question No. 2

In question 2ai candidates were asked to give two ways how a motor assembly design had considered design for manufacturing assembly (DFMA) in its design. This question had a varied response from candidates. In some cases candidates were simply stating features of the design instead of how these features had been added due to DFMA. In addition, some candidates gave responses related to the drawing of the product rather than its actual design. However, a large number of candidates were able to give valid responses that focused on the key design decisions made within the motor's design that enabled successful manufacturing and assembly.

Following the consideration of the motor design, part 2aii asked candidates to explain what is meant by the term design for manufacturing assembly (DFMA). Generally most candidates were able to give some valid points relating to the consideration of assembly and manufacturing processes during the development of the design. Where understanding was less developed candidates were giving generalised responses related to costs or design development with no real consideration of manufacturing or assembly techniques. Centres are reminded to consider the engineering nature of the paper and ensure candidates develop an understanding of design principles in conjunction with the engineering processes that impact on these.

Question 2b required candidates to state two ways that products can be designed for disassembly. On the whole responses were given relating to temporary fixings or standard components. This ensured that the vast majority of candidates were able to achieve marks here. Where responses did not achieve marks, candidates were giving generalised and non-specific statements about a product or component design that had little consideration for how this aided disassembly.

In part c of question 2, disassembly was further explored with candidates required to explain why design for disassembly is an important consideration in the design of new products. Many candidates focused on the requirement for maintenance or repair of the product. This point is valid and provided some excellent responses. There were some instances where the focus of this related to the customer wanting or needing to disassemble the product, which although valid in part, could lead to some generalised responses that lacked the understanding from a manufacturing or design perspective to secure all the marks. In general, a greater emphasis on the ability to separate materials or components at the end of life in conjunction with the advantages of maintenance was required.

Question No. 3

Question number 3a required candidates to define the terms market pull and technological push. In general this question was not answered with the clarity required to secure the marks. Part i of the question was answered substantially better than part ii. Candidates had some understanding of market pull and were able to relate this to market demand in a large number of cases. Part ii, however related to technological push which provided very few strong responses. Answers were focused on the improvement of technology in products but not how this can subsequently create new markets.

Part 3b, asked candidates to state two factors that can create market pull. As shown in the first part of question 3 there were some positive responses where candidates were able to demonstrate an understanding of the factors that can drive market pull such as fashion trends or the requirement for a design solution. However, there were a large number of generalised statements related to the market that did not state specific factors that create market pull.

In part 3c, candidates were required to give two methods that designers can use to identify the needs of a market. This question required responses related to specific tools utilised to carry out research into the target market. Candidates who gave general responses related to research did not achieve the marks here. Where specific research techniques were given as responses candidates were able to successfully achieve full marks.

Question 3d required candidates to describe the process a designer may follow to develop a design specification from a design brief. In a large number of cases this question did not generate high quality responses. Many candidates confused the question with the design cycle and discussed the stages of this process instead of how a designer may develop a detailed specification in dialogue with the client from the initial brief. In addition, marks were lost when candidates did not provide extended explanations, instead listing criteria in single word or one-line sentences.

Question No. 4

Question 4a focused on anthropometrics. It is clear from the responses seen that large numbers of candidates do not understand the differences between anthropometrics and ergonomics and are using the terms interchangeably. Part ai, asked candidates to state what is meant by the term anthropometrics. In large numbers of responses candidates were defining the term ergonomics and not anthropometrics and the measurement of the human body. In part ii, this error was continued with candidates giving responses related to ergonomic considerations of the bicycle instead of the anthropometric measurements of the human body that would need to be considered in its design.

Part 4b required candidates to describe how the bicycle could be influenced by ergonomics. On the whole this question was answered well clearly showing that candidates understanding of ergonomics is far greater developed than their knowledge of anthropometrics. A large number of responses focused on the comfort of the bike, which although valid in part is achieved through the effective positioning of key features of the bicycle.

In question 4c, candidates were required to give two ways that new materials can impact on bike design. Overall, most candidates were able to give characteristics associated with material performance such as improvement in weight or strength. Centres are reminded to develop candidates' knowledge of materials and processes which would allow them to provide responses of greater depth that may focus on how the material has allowed for the production of more complex geometry or reduction in components. On the whole however, this question was answered well.

Question 4d asked candidates to explain how new production processes may impact on the design of a new product. Responses to this question varied with some candidates able to give fully developed responses that discussed how automated processes or new techniques have been able to increase the complexity, quality or accuracy of components. However, large numbers of candidates gave generic responses that did not give specific impacts on component design or performance and therefore were not able to access all the marks available.

Question No. 5

Part 5ai required candidates to state two ways that an ice cube could be tested during the development of its design. On the whole candidates were successfully able to state two ways this would be possible by considering the strength and temperature requirements of the product and the material.

In part 5aii, candidates had to explain why testing is important when developing a new product. Most candidates were able to give responses that explained the need to ensure that products are safe before being put on sale and the subsequent implications and consequences should this not be the case. Overall candidates were able to access multiple marks in this question.

Part 5b focused on error proofing. As in previous series' of the paper when error proofing has been the focus of a question, candidates have generally not understood the term and have instead given responses relating to testing of products to remove errors, rather than designing products that cannot be used the wrong way due to their design. Part i asked candidates to give two ways how designers can incorporate error proofing into designs. Responses generally related to testing throughout design and production to remove errors found in the design or components. This was carried through into part ii where candidates continued to discuss testing when asked to explain the impact of error proofing on the operation of new products. Candidates generally gave responses related to how testing during design or production to remove faults stopped issues when the product went on sale. Only a small number of candidates were able to explain how error proofing can stop the product being used incorrectly due to its design. In some cases candidates gave responses related to design of components to ensure only one way of assembling the product during production. These responses were valid and gained marks.

Question No. 6

Question 6ai required candidates to label an engineering drawing to show where a specific tolerance had been given to a dimension. Many candidates did not label the drawing and therefore could not gain the mark. In general, responses were mixed. Some candidates labelled the general drawing tolerance instead of the specific one. Centres are reminded to ensure candidates are taught to read the paper in detail to ensure they understand the requirements of each question.

In part 6aii candidates were required to explain why drawings may have specific and general tolerances. Large numbers of candidates discussed tolerances without explaining why there may be a need for general and specific tolerances on engineering drawings. Candidates' knowledge and understanding of tolerances has developed and many were able to give responses that could gather marks based on this but marks were lost in some cases due to not explaining why different types of tolerance may be found.

Question 6b required candidates to show understanding by assessing their quality of written communication in a discussion question that focused on how designers can influence final production costs when developing new products. 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 the impact material selection, production process and components used impacted on the overall cost of production. Some candidates focused on selling price rather than production cost 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 which, 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.

R106 Product analysis and research

General Comments

Samples from centres were generally received for moderation by the deadline date.

A Unit Recording Sheet (URS) was supplied for each candidate in the sample.

Standard of assessment by centres was generally consistent but in some cases there was evidence of generous or variable internal assessment. In most cases marks had been clearly entered on the URS and correctly totalled. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received.

Teacher commentary on the URS was generally useful, but in several centres, would benefit from the inclusion of further commentary in order to assist with the moderation process. Commentary should also include page numbers and annotation to identify clearly which learner 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 cannot be used again for others. There was sometimes no further annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the live assessment for LO3 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres are permitted to use alternatives. Centres are reminded that witness statements should be used to corroborate and support evidence generated by the learner themselves, and cannot be used as an alternative sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated, and also include the candidate number.

There was some evidence 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.

Comments on Individual Learning Outcomes

LO.1
This LO requires learners to recognise and explain the relationships between commercial production and its impact upon product/component design, end of life influence upon product/component design, and the importance to conformity to legislation and standards with reference to the products being analysed. Many learners were able to recognise the topics as discrete issues rather than interrelated issues. In some cases, analysis of products was generalised - relationships between commercial production and its impact upon product/component design was not adequately addressed, end of life considerations were isolated and not related to the products reviewed. Recognition of conformity to legislation and standards sometimes lacked depth, and again, was isolated and not clearly related to the products reviewed.

LO.2
LO2 requires learners to analyse existing products and to identify their strengths and weaknesses. Learners should seek to communicate detailed information that demonstrates comparisons having been made, culminating with a summary of their research. To consistently

access high mark bands, strengths and weaknesses need to be much more insightful, comprehensive in detail and explanation, and comparing the qualities of one product against the qualities of at least one other similar product. The LO should conclude with a detailed summary of the findings.

LO.3 a and b
The intention of this LO is that candidates safely dismantle an actual product and provide an analysis of this in terms of materials, construction and how it was manufactured. Candidates are required to produce evidence of this disassembly process, which could be in the form of annotated photographic evidence. It was often implicit that candidates did this; however, there were often cases of no candidate evidence with a witness statement being relied upon almost entirely for this LO. The witness statement can be used to support and corroborate learner-generated evidence. Things that might be corroborated are safe working, safe use of tools, working competently and accurately, and level of independent working. The use of witness statements is explained in Appendix A of the unit specification handbook.

Conclusion and Recommendations

Level of detail on the URS (and on learners' work) could be improved for some centres which would greatly assist with the moderation process.

Both LO1 and LO2 were often well attempted, although learners were not sometimes able to make connections in LO1, and the quality of research often made up for the lack of objectively comparing the strengths and weaknesses of products in LO2.

For LO3 candidates could evidence disassembly through photographic evidence or similar. A witness statement, or similar, should be used to corroborate how safely and independently learners worked and if they used the appropriate tools. Centres might consider alternative means of providing evidence (e.g. videos of disassembly being performed) or can use the pro-forma witness statement provided with the Live Assessment. Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R107 Developing and presenting engineering designs

General Comments

Samples from centres were generally received for moderation by the deadline date.

A Unit Recording Sheet (URS) was supplied for each candidate in the sample.

Standard of assessment by centres was generally consistent but in some cases there was evidence of generous or variable internal assessment. In most cases marks had been clearly entered on the URS and correctly totalled. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received.

Teacher commentary on the URS was generally useful, but in several centres, would benefit from the inclusion of further commentary in order to assist with the moderation process. Commentary should also include page numbers and annotation to identify clearly which learner 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 cannot be used again for others. There was sometimes no further annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Where photographs are presented as evidence can centres please ensure that these are annotated, and also include the candidate number.

There was some evidence 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.

Comments on Individual Learning Outcomes

LO.1
Nearly all candidates were able to produce sketches which were often rendered. Centres are reminded that both 2D and 3D sketches are required which include rendering using shade, tone and texture. Rendering was sometimes a little basic. Some candidates failed to use IT to enhance their design proposals. To secure marks in the higher mark bands sketches should also be labelled and include suitable annotations. Level of learner independence and competence for this LO can be supported using a witness statement, or noted on the URS.

LO.2
The intention of this LO is for candidates to use engineering drawing techniques to produce both 2D and 3D drawings (ideally using hand drawing techniques). These are explained in the unit specification, and can include isometric, oblique and 3rd angle views and should include materials, parts lists, sectioning etc. There was often limited evidence of technical drawings (both 2D and 3D) being produced by candidates apart from those done by CAD for LO3 which could be awarded marks. This LO also requires that candidates evidence knowledge from other units e.g. R106. This could sometimes be more explicit (or explicitly identified by the marker on the URS).

LO.3
It was evidence that most candidates were able to use CAD to produce drawings quite adeptly. A few were quite basic, and did not communicate sufficient detail for the design proposals. There was also evidence of candidates being awarded marks where there was no evidence of CAD

being attempted. To achieve marks in the higher mark bands for this LO fully annotated design ideas with details of manufacturing, materials and methods are required (see assessment guidance on unit specification). Level of independence and competence for this LO can be supported using a witness statement, or noted on the URS by the marker.

Conclusion and Recommendations

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

LO1 was often well attempted. There was good evidence of sketching, appropriate annotation and detailing, and the use of computers to produce augmentation. To secure marks in the higher mark bands sketches (which must be both 2D and 3D) should also be labelled and include suitable annotations.

LO2 requires candidates to present designs in 2D and 3D using formal drawing techniques. This was well attempted by some centres, although for some centres there was often limited evidence of technical drawings.

For LO3 CAD was attempted with varying levels of success, but with some excellent examples. In some cases, however, final presentations lacked detail and did not communicate sufficient detail for the design proposals.

R109 Engineering materials, processes and production

General Comments

Most candidates attempted all of the questions on the paper. In a significant number of cases, however, candidates' knowledge of some sections of the specification appeared to be very limited and it was quite common to find questions in these sections not being attempted at all. This was particularly so in the final two questions on the paper.

Responses to questions relating to engineering materials were generally rather varied, and in the case of those dealing with commonly used engineering components responses were very disappointing. In questions where candidates are asked to describe processes or explain particular benefits or effects, it should be noted that simplistic answers are not suitable responses.

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. It is most important that candidates take the time to read through the question paper before attempting to answer questions.

Comments on Individual Questions

Question No.

1(a) Most candidates scored well on this question, but overall the results were very varied, with marks from zero to the maximum of six being awarded. There was some confusion between pure metals and alloys, and it appeared that a number of candidates had given their responses by guesswork. The most frequently seen incorrect responses were those of giving Titanium as an alloy, and Brass and / or Bronze as pure metals.

1(b) Responses to this question were generally simplistic statements rather than the reasons for use of non-ferrous metals asked for in the question. An example of this was the statement that ferrous metals rust, without relating this to non-ferrous metals at all. Only the higher achieving candidates gained full marks by giving two valid and justified reasons, often making reference to the fact that ferrous metals are generally magnetic.

2(a)(i) Most candidates knew that malleability referred to a materials ability to be shaped or bent easily. Many neglected to mention the fact that this could be done without the material breaking, however, resulting in only one of the two marks available being awarded.

2(a)(ii) Responses to this question were rather varied, with many candidates scoring full marks and others scoring zero. A few candidates lost a mark by repeating malleability from part (i), and some were only able to give one other property rather than three. A significant number of candidates gave no properties at all in their response and simply wrote the names of specific materials such as copper and aluminium.

2(b)(i) Most candidates attempted this question but it was common to see only one correct example of a composite material given. A significant number of candidates did not score at all, often by giving examples of plastics or sometimes even basic metals. Carbon fibre, concrete and GRP were the most frequently seen correct examples, but wood based composites such as MDF and plywood also appeared occasionally.

2(b)(ii) Only a limited number of candidates scored full marks on this question, largely because many responses were simply descriptions of alloys being mixtures of metals, rather than explanations of their advantages over pure metals. Most candidates referred to mixing metals and combining properties to improve overall characteristics, but few mentioned other factors, such as alloys often being cheaper than pure metals.

3(a) Responses to this question were very disappointing, and few candidates were able to correctly identify more than one or two of the threaded components shown. The bolt was correctly named by most candidates, and some also identified the wing nut correctly, but recognition of the other components was very rare.

3(b)(i) Most candidates attempted this question but few scored full marks by giving three tools required to cut the M6 internal thread. Drills and taps were frequently seen, but marks were often lost by giving drill sizes that would result in no thread being produced. In some cases candidates gave both taps and dies as their response, while others simply provided a list of random tools or machines that were completely unrelated to the process.

3(b)(ii) A number of candidates did not offer a response to this question, and some were only able to give one correct response. The use of a die was seen occasionally, but credit was also given for reference to the use of manual or CNC lathes.

4(a)(i) The focus of this question was 'machine processes' but in a number of cases candidates lost marks by naming machines used rather than the processes themselves. Where correct responses were given, these were often the basic processes of milling, turning and drilling, as given in the specification, but others such as laser cutting and water-jet cutting were also seen.

4(a)(ii) Many candidates demonstrated good understanding of safety by giving three safety precautions relevant to the use of machines for material removal. Responses were not always simple references to items of Personal Protection Equipment (PPE), although credit was given where these items were relevant.

4(b)(i) Only a limited number of candidates gave the correct response of compression moulding for this question and in many cases two or more boxes had been ticked in the hope that one of these was correct. It should be pointed out that, where this approach is taken, the mark cannot be awarded even if the correct answer is one of those chosen.

4(b)(ii) Responses to this question were very varied, and only the higher achieving candidates scored full marks on it. Reference to recycling was quite common but in many cases candidates suggested that finished products could be reshaped if they 'came out wrong'.

5(a) This question was generally not well answered, with most candidates scoring no marks on it at all. It would appear that candidates are familiar with the basic CNC lathes and milling machines, but not with other more specialised CNC machinery. The most commonly seen response referred to CNC machining centres being places where only CNC machines were used or stored. Only a limited number of candidates scored marks by mentioning the computer numerical control of a machine with multiple axes.

5(b) As with part (a) above, this question was generally not well answered. Some candidates referred to the machine being used to bend metal parts, but descriptions of the operation of the machines were very weak, with no mention at all of the computer control aspect. A significant number of candidates attempted to produce a response by re-arranging the words in the question, often resulting in the suggestion that something was pressed to operate a brake in an emergency.

5(c)* It was clear from the responses to this question that most candidates had quite good knowledge of general CNC machining, and the full range of marks was used across the cohort. The most commonly referred to factors were increased production, high initial cost and loss of jobs, but marks were sometimes lost by candidates repeating points in a rather disjointed response.
The candidate's Quality of Written Communication (QWC) was assessed in this question, and marks were awarded for well written answers, despite technical content often being somewhat limited.

6(a) This question was generally well answered with many candidates scoring full marks. The high cost of buying and installing new equipment was fully understood and featured in most responses, with maintenance and energy costs also being regularly seen.

6(b) Explanations of the impact of modern technologies on working conditions were generally quite weak, and few candidates scored more than one or two marks on this question. In a number of cases candidates simply referred to the impact of modern technologies on production and mentioned increased accuracy and lack of human errors. Whilst most candidates were aware of the fact that the working environment would be cleaner, explanations as to why were few and far between.

6(c) Responses to this question were very varied, and marks awarded ranged from zero to the full mark of four. References to email, video conferencing and Skype were quite common, but descriptions of their use were rare. In some cases, candidates lost marks by giving benefits of using the technology rather than descriptions of its use as asked for in the question.

R113 Electronic principles

General comments

Most 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.

Comments on Individual Questions:

Question 1

(a) Generally well answered with types of power sources being well known.
(b) The formula for calculating the current through a resistor I = V/R was well known with a majority of candidates achieving maximum marks.
(c) The formula for calculating the power input to a motor P = VI was well known with a majority of candidates achieving maximum marks.
(d) The formula for calculating the energy used by a heater W= Pt was reasonably well known but there was much confusion when dealing with the unit of energy which should have been Wh or kWh or Ws or J.
(e) Generally well answered with the concept of resistors connected in series being well known.

Question 2

(a) The term ‘momentary action switch’ was not well known with a high proportion of candidates not giving an example of its use.
(b) The majority of candidates named each component correctly from its given symbol.
(c)(i) The symbol drawn for a fuse was generally well known, although some candidates were unable to draw this fundamental important symbol.
(c)(ii) Generally well answered with a wide range of correct responses being given.
(c)(iii) Generally well answered.

Question 3

(a) Generally well answered with a majority of candidates achieving maximum marks.
(b) Candidates needed to demonstrate understanding of a Nand gate or a XOR gate but few were able to do this.
(c)(i)(ii) Candidates were unable to demonstrate the required knowledge and understanding of how to complete a truth table from a given circuit diagram consisting of three gates. In turn they were unable to identify the logic gate produced by the circuit given.
(d) Very few candidates were able to describe how quantum tunnelling composite is used as a switch.

Question 4

(a) Generally well answered with a majority of candidates achieving maximum marks.
(b) Generally well answered with good quality circuit diagrams with the majority of candidates achieving maximum marks.
(c) The function of a voltage regulator was not well known.

Question 5

(a) Generally well answered with a variety of sketches and notes being provided.

(b) A high proportion of candidates did not complete the circuit diagram correctly.
There was much confusion of how to connect a variable resistor either to the inverting terminal or the non-inverting terminal of the operational amplifier. A number of candidates connected the variable resistor to the incorrect terminal of the operational amplifier.

Question 6

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

(b) A proportion of candidates answered this question with many giving a reasonable discussion of the function of photodiodes and phototransistors in electronic circuits. The applications named by candidates were wide ranging.
A few candidates had no idea of the function or application of these devices.
In general terms it seemed that the use of spelling, punctuation and grammar had improved in this series.

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