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OCR
Oxford Cambridge and RSA

GCSE

Engineering (Double Award)

General Certificate of Secondary Education (Double Award) **J344**

General Certificate of Secondary Education **J322**

OCR Report to Centres June 2016

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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

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A621 Engineered products

General Comments:

It was pleasing to see that this year the majority of Centres were working closely to the OCR Specification Assessment Grid and that work presented was organised in a manner that followed the identified strands from the grid. This made the moderation process easier as moderators could follow the candidates' flow through the process and recognise judgements made by the Centre. It was also beneficial to candidates when A621/URS forms had been annotated with page references to highlight where marks had been awarded for key pieces of information identified in the strand descriptors. The main issues this year arose from the administration of the examination especially missing documentation, as far too much time was spent by moderators seeking missing MS1, CCS160, CSF/A621 forms which are supposed to be submitted to the moderator with the sample of work. Arithmetical errors were also an issue as well as transcription errors when Centres transferred marks from CSF/A621 forms onto MS1 submissions. It is highly recommended that Centres use the electronic version of CSF/A621 to when recording a breakdown of candidates' marks.

Work submitted for Engineering Unit A621 must contain evidence of studying a product from the list provided by OCR as detailed in the subject specification.

All evidence for assessment must be contained within the candidate's portfolio; this should include a range of quality photographs showing the product produced from a variety of angles. The photographs should be of a reasonable size so that the moderator can verify the marks awarded by the Centre.

It should be noted that witness statements are valued but these are only seen as supportive, the specification requires candidates to provide their own evidence of health & safety issues and quality control procedures. Photographic evidence of these aspects being carried out is an excellent way to record and show how they have been applied to the project.

Centres should note that writing frames are not allowed and that it is felt that these actually inhibit middle to high ability candidates, preventing them from displaying their flair or understanding as they work through the required sections of the assessment grid. While it may be beneficial to direct the candidates towards areas that need to be covered, it may be more appropriate to use page headers rather than grids as candidates then have unrestricted space to provide their responses which can be developed over a number of pages.

Comments on Individual Questions:

Unit A621 1A Study of an Engineered Product

Candidates should identify a product to study from the list published by OCR. Once the product has been identified it should be analysed with two other similar products from different periods on its evolutionary timeline.

When using the assessment grid it is important that Centres consider the introductory requirement at the beginning of each strand. In the first column of the assessment grid a basic description or a basic explanation may include brief notes or a list of key words. For candidates to progress to the second column they must describe and explain their work and should present more text in order to support their findings and to show a development of their knowledge and understanding of the topic being covered. Candidates who are awarded marks from the third column of the assessment grid must provide detail to their descriptions and explanations as well as justifying the information provided.

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A621 1A Strand 1

This section requires the candidate to reflect upon the products identified for study. The main focus should therefore be directed towards analysing the product and not purely presenting information in generic terms, although some general information may be appropriate as a starting point or background to the study. This strand is an opportunity for candidates to show their understanding of how technology has had an impact on society as well as how components have developed/evolved over a period of time.

Candidates should analyse each of the products identified and give consideration to the following areas; the impact of modern technologies, smart materials and components on their development. Modern materials, smart materials and components should be relevant to the products studied.

Written evidence should be provided to highlight the advantages and disadvantages that the use of modern technology has brought to society. Once again this aspect should relate to the product being studied and how it has benefitted from technological developments.
Good practice was evident when candidates broke down each of the requirements of this strand and addressed them as separate topics presenting the information in a written format or as a table, with images of the selected products provided to support the text.

A621 1A Strand 2

In this strand candidates should identify appropriate materials and components to analyse. The main materials used in the production of the product studied should be listed; similarly appropriate components should be identified. Once this has been done candidates should explain their use, including reference to properties, characteristics, performance and cost. With components an explanation of how they work and their application may be appropriate. Depending upon the products studied it may be impossible to identify all the components therefore a range of key components should be selected and analysed. Throughout this section images of components may be appropriate to support explanations of their function and characteristics.

It may be to the candidate's advantage to address materials and components as two separate parts, with part one analysing appropriate materials and their relevant properties, characteristics, performance and cost. Part two would follow a similar approach to part one but with reference to components.

Good practice for this section saw candidates identifying, explaining and justifying a range of different materials and components that had developed over a period of time. Information was presented in the form of a table that identified materials and an additional table for components that had been used in the manufacture of the product studied with an explanation given regarding their properties, characteristics, performance and cost. Other candidates began the section by presenting photographs of disassembled products, labelling and explaining the function of components.

A621 1A Strand 3

Candidates are expected to identify, explain and justify a range of engineering process that have been used in the production of their selected products. The processes presented should be used in some part of the selected products manufacture and should not include general processes that have been studied as part of examination preparation which have no relevance to the product.

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It is important that a range of relevant processes are included and that a detailed explanation is given as to how the process is carried out stage by stage, images to support the information may be beneficial.

Good practice was evident by candidates who identified and explained a range of different engineering processes. Information and images were used to help explain a variety of engineering processes that had been used over a period of time as the product had evolved.

A621 1A Strand 4

In this strand candidates should suggest modifications that can be carried out on the selected product so that the needs of present and future users are met. The use of modern technology should be considered in the development of the selected product. The material presented in this section could allow candidates to do some "blue sky" thinking and give their opinions of how the product studied may develop in the future. Reference to design concept ideas may be a good starting point.

Sustainability issues should be explained and evaluated. Topics such as recycling, other green issues, selection of materials and resources should be considered with information recorded and presented. This is not an opportunity to discuss the benefits of sustainability and "green issues" in generic terms as information presented must relate to the product studied. Many candidates showed evidence of their awareness of the "6Rs" however to gain marks in the higher bands this knowledge needs to be applied to the product being studied.

Good practice saw candidates dividing their work into two parts one addressing modifications to the design solution and the other dealing with sustainability, with images used to support all written explanations.

Unit A621 1B Engineering a Product

Unit A621 1B Strand 1

In this this strand a client design brief should be selected from the list given in the specification. The brief should be analysed, researched and a specification produced which highlights the key points. The specification should be more that a list of keywords or bullet points. It is expected that key points will be explained and justified. In strand 2, the design stage, the specification should be referred to with comments recorded. By following this approach the requirements of the statement "produces and applies a specification" (on the assessment grid) will be met.

A continued concern is that many of the controlled assessment folders presented for moderation do not contain any input from a client or that this input was often very limited. This lack of a client input prevents candidates from gaining higher level marks in later sections.
Good practice saw candidates analysing a design brief, carrying out relevant research on the topic, analysing existing items and then presenting a revised specification. The specification was then used, and referred to, in the following section when the candidate presented a range of ideas that met the client’s requirements.

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Unit A621 1B Strand 2

In this strand candidates are expected to develop a range of ideas that will answer the design brief. A good starting point is a range of freehand sketches that should be developed into pictorial views leading to a final selected idea following a discussion with the client. Candidate annotation and justification of their thinking is a key element of this section.
Ideas should be presented using a range of techniques including annotated sketches, 3D views and engineering drawings that meet current industry standards.

Once suitable solutions have been developed a final product should be selected and the reasons for its choice explained and justified. This should be presented to the client with feedback sought. The candidate should present evidence of their response to the clients feedback with any changes made explained and justified. It is important that reference is made to client feedback here as without it candidates are unable to gain higher marks having not met one of the sections descriptors ("considers clients feedback, responds appropriately and justify changes made").

Design ideas should be cross referenced to the points made in the specification, this can be achieved through annotation of drawings or a table where drawings are numbered and given a rating against key points from the specification. Some candidates did not provide a presentation of the final idea or sometimes when it was included it lacked feedback from a client regarding its suitability and how it met initial needs.

Good practice saw candidates presenting a wide range of ideas, normally five or more, being presented with annotation referring to key points from the specification. Such ideas were developed to include notes on materials, construction details and components. A final idea was then developed, drawn using a variety of techniques including CAD and evaluated. It was then presented to a client using a power point presentation. Comments from the client were recorded and considered with modifications to the design carried out, presented and justified.

Unit A621 1B Strand 3

Candidates are expected to complete a high quality prototype of the final idea. As the folder is the only place that evidence of the product can be seen it is important that every candidate includes a good range of photographs, preferably from different angles and possibly with the product performing the function for which it was designed. In some of the moderated folders it was difficult to judge the quality of candidates work as a single photograph was presented and sometimes it was only very small or the quality of the photograph was poor.

The expectation in this section is that a quality/high quality product is produced especially for the mid to high range marks to be awarded. Centres should carefully consider the quality and level of completion of work when awarding marks as incomplete models or products that have only used one or two processes do not necessarily constitute quality or high quality prototypes.

Unit A621 1B Strand 4

Candidates should show evidence that they have selected and safely used a wide range of appropriate materials, parts and components, processes, tools and equipment. They should appropriately apply and explain a range of quality control techniques. Witness statements are not acceptable as the sole evidence for health and safety issues or quality control procedures, the candidate must provide his/her own evidence for these aspects through the use of text, photographs or a log of events.

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It is important that health and safety procedures and quality control checks are not presented in generic terms but relate to the product being produced.

Good practice saw candidates using production plans that identified health and safety issues and quality control checks. Such information was related to the product being produced with detail given as to what the checks would be necessary and how they would be carried out. Evidence was presented showing that candidates had carried out or applied risk assessments on equipment to be used. Good use was made of photographic evidence to support safe practice and to highlight quality control in action.

Unit A621 1B Strand 5

In this strand the candidate should reflect on what they have done and what could be changed if they were to attempt the project again. It is also a place where they should consider how modern materials, processes and technologies could have been used if they had been available. In order to gain mid to high marks candidates should present evidence considering both of these aspects it is not enough for them to carry out a basic product evaluation.

Good practice was seen when candidates used diagrams and modelling to suggest and explain modifications to their final product including alternative production methods, the use of 21st century equipment and smart materials.

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A622 Engineering processes

General Comments:

Most candidates attempted all of the questions on the paper but, in a number of cases, 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 marks can easily be lost simply by not providing an example where one is asked for in a question.

A clear understanding of the application of basic workshop procedures was quite limited in many cases, with a number of candidates being unable to provide a suitable method of carrying out a simple procedure. General engineering processes, on the other hand, were quite well known, as were health and safety precautions relating to them.

Knowledge of engineering components continues to be limited in many cases, as does a clear understanding of the application of modern technologies in the various stages of engineering manufacture.

Comments on Individual Questions:

Question No.

1(a) This question was well answered by most candidates, with many scoring full marks on it. Where marks were lost, this was often due to incorrect responses being given for the sectors producing wheelchairs and disc brakes, and it also seemed that some weaker candidates had simply selected sectors from the list at random for their responses.

1(b) Most candidates scored well on this question, with Automotive and Aerospace being popular choices for the sector used in the response, and most parts of cars and planes were seen as examples of products made in the chosen sector. Where an incorrect sector had been given, an 'error carried forward' mark was allowed for appropriate examples of products for that sector.

2(a)(i) Very few candidates gained all three marks on this question as the lists of stages given for making the clamping plate were often incomplete. The most common reason for loss of marks was the lack of the stage removing burrs/sharp edges following the drilling and tapping of the two holes, and in some cases the holes were not even drilled prior to the thread cutting stage.

2(a)(ii) Only a limited number of candidates were able to name the tools needed when cutting the M8 threads, and only the tap was seen with any regularity. The second correct response varied between the tap wrench and a vice or clamp to hold the workpiece, but a number of candidates suggested that a drill would be needed, despite the fact that the holes were mentioned in the question. There was also some confusion between taps and dies, and some candidates gave both in order to ensure that one mark would be gained.

2(b) Laser cutting was often seen as one example of an industrial process that could be used to cut the shape of the clamping plate, and most candidates scored at least one mark on the question. The higher achieving candidates used pressing/stamping for their second example, but in a number of cases account was not taken of the volume of production, and milling was only accepted if reference to CNC was made.

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3(a)(i) – (v)

Answers to these questions were very variable and, in a number of cases, it appeared that materials had been chosen from the list by guesswork. There was considerable confusion between ceramics and composites, and also some between ferrous metals and alloys, with aluminium often being seen as either one or the other.

3(b) This question discriminated well, with marks from zero to full marks being awarded. The higher achieving candidates scored well by stating that a non-ferrous alloy was a mixture of metals not containing iron, and giving a suitable example. In a number of cases only one of the important points was given, normally the lack of iron, and all too often a mark was lost by not providing the example asked for in the question.

4(a)(i) Almost all candidates answered this question correctly, with the majority giving safety goggles as an item of PPE that should be used when operating a drilling machine.

4(a)(ii) This question was well answered and most candidates scored full marks on it by giving two relevant safety precautions. In a number of cases, however, marks were lost by candidates giving one or more examples of PPE in their responses, despite the fact that these were ruled out in the question.

4(b)(i) This question was generally well answered and many candidates scored full marks by giving three appropriate joining and assembly processes. Most responses included soldering and brazing, but again marks were lost where candidates had missed the word ‘other’ in the question, and had given variants on the welding process.

4(b)(ii) Few candidates gained full marks on this question, which asked for tools or items of equipment. Soldering was the most popular choice of process for the question, and in many cases candidates lost a mark by giving solder as one of their responses, this being classed as a consumable. A fully correct response for this question would be a soldering iron and a soldering iron stand, although a damp sponge was also accepted as being appropriate as an item of equipment.

4(c) It was disappointing, and somewhat surprising, to see that more than half of the candidates were not aware of the fact that CNC stands for Computer Numerically Controlled. A number gave slightly different wording, which was accepted as being sufficiently descriptive and awarded the mark.

5(a) Answers to both parts of this question were generally quite basic, but most candidates scored at least one mark on each of them. Few candidates gave sufficiently justified responses to earn full marks, and two marks overall was quite common. The weakest descriptions seen were those relating to the ‘Modifying designs’ stage of the process, where responses tended to be merely a repetition of the wording of the stage.

5(b) This question was not well answered generally, with a number candidates missing the main focus of the question and basing their responses on the use of modern technologies in manufacturing by using CAM machines. In some cases candidates appeared to think that ‘information’, ‘communications’ and ‘digital technologies’ were three entirely separate entities, and divided their response up accordingly.

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6(a) – (c)

Knowledge and understanding of engineering components and their use was generally quite limited, and few candidates scored well on the three parts of this question. In many cases marks were lost where candidates had related their responses to products rather than components, a typical example of this being the reference to 'suspension' in part (c), which asked for a pneumatic/hydraulic component. The best responses seen were those to part (b), where electrical/electronic components such as fuses and LEDs were named, and appropriate examples of use described. Some frequently seen examples of mechanical components were nyloc nuts, gears and circlips, but descriptions of the use of these were often too simplistic.

7(a) Responses to this question were very varied and showed that knowledge and understanding of quality control procedures was generally quite limited. Many candidates did refer to the taking of random samples from production for quality checking, but only the higher scoring candidates went on to give the reasoning behind this. In a significant number of cases candidates related their responses to giving samples to customers for them to test and evaluate.

7(b) Most candidates showed an understanding of the effects of not carrying out quality control, with material wastage, production of unsafe products and lowering of a company's reputation featuring quite frequently. Marks were often lost through simple repetition of points, or by giving overly simplistic responses with little or no justification.

8* Almost all candidates attempted this question, but marks awarded were generally quite low as responses were often rather vague or too simplistic. Most responses contained some reference to recycling, and 'green' energy sources also appeared occasionally, but a number of candidates moved away from the 'environment' focus of the question and gave responses that referred mostly to the more general benefits of using modern technology, particularly in manufacturing.

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 limited.

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A623 Real world engineering

General Comments:

It is essential that Centres closely refer to the statements contained on the Unit Assessment grid (A623/URS) when allocating marks for the candidates work. A best fit approach is recommended however when awarding marks evidence to meet the grade descriptors must be contained within the folder. In order to support the moderation process it would be beneficial if page references for the marks awarded were recorded in the appropriate section on the A623/URS form.

Good practice was evident through the use of numbering pages and dividing work into sections following the assessment grid descriptors. This allowed page references to be entered on the URS form directing the moderator towards relevant evidence which supported the marks awarded.

Comments on Individual Questions:

Unit A623 3A Real World Engineering

Candidates should select a product to study from the list published by OCR in the subject specification.

When applying the assessment grid it is important that Centres consider the introductory requirement at the beginning of each section. In the first column on the assessment grid a basic description or a basic explanation may include brief notes or a list of key words. For candidates to progress to the second column they must describe and explain their work and should present more text in order to present their findings and to demonstrate their knowledge and understanding of the topic being covered. Candidates who are awarded marks from the third column of the assessment grid must provide detail to their descriptions and explanations, justifying the information provided.

A623 3A Strand 1

In this strand candidates should present and analyse their selected product for study. They should identify and explain the stages that are carried out in the production of the product. It is important that Centres note marks are awarded for the production of the product and not its design.

Good practice was evident where candidates had broken down the production process, listing the various stages and then explaining each in turn with information provided in a written format or as a table. Images were provided of the selected stages in order to support the information given.

A623 3A Strand 2

Candidates are expected to identify, explain and justify a range of engineering process and quality control techniques that are used in the production of their selected product. A range of processes that could be used to produce the product should be identified. Each process should be fully explained stage by stage. The range of processes should include at least five different examples depending upon the complexity of the product studied. It is important that candidates identify and explain quality control procedures that may be carried out during each process.

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Good practice was evident by candidates who identified and explained a range of different engineering processes. Information and images were provided to help explain a variety of engineering processes and quality control checks that had been used.

A623 3A Strand 3

Candidates should provide details of the materials and components used in the production of their selected product. For candidates to perform well in this section they should present a detailed explanation of the information and not only a list of key words. Appropriate materials that may be used in the production of the product should be identified and then for each material their functions, properties and characteristics explained. A similar procedure should be carried out for components, with appropriate items listed and/or images presented and explained.

Good practice saw candidates dividing this section into two parts - one dealing with appropriate materials and the other with relevant components. Candidates then explained, analysed and justified materials and components identified in part 1 and part 2 using a table with column headings of function, property and characteristics.

It should be noted that unless both materials and components are considered mid to high marks cannot be gained in this strand.

A623 3A Strand 4

In this strand candidates should identify and explain systems and control technology that are used to organise, monitor and control the production of their selected product. Systems and control technology identified in this strand must be relevant to the product being studied and not be explained purely in generic terms.

Good practice saw candidates identifying a list of stages to highlight key systems and various stages of production that used control technology in engineering the product. Images were used to support written text and this helped candidates fully explain how their product was created.

A623 3A Strand 5

Candidates are expected to identify and explain the impact of modern technologies when engineering their product, the work presented must relate mainly to the product studied and not be purely explained in generic terms.

When carrying out work on this topic candidates should identify and explain a range of modern technologies. They should explain how the use of the modern technology has changed the production of their selected product and evaluate if such changes are good or bad explaining how this has effected production times, workforce, quality, value for money and resources.

Unit A623 3B Making an Engineered Product

Unit A623 3B Strand 1

Candidates working on this strand should select a design situation from the list given by OCR. Once a design situation has been selected it should be analysed and a production plan produced.

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Good practice saw candidates analysing a design situation and producing a production plan that identified an appropriate sequence of making with time estimates given for each stage. Materials, tools, equipment and processes to be used were highlighted in the production plan. Health and safety aspects and quality control checks to be carried out were often included.

Unit A623 3B Strand 2

Candidates are expected to produce a prototype that meets production plan identified in strand 1. It is important that a solution is presented in this strand and that it is evidenced in the portfolio, without such evidence the moderator cannot support the marks awarded by the Centre.

The prototype should be produced using appropriate materials and should be able to function as required in order to fulfil the design situation. As this product can only be moderated through the use of photographs it is important that candidates present a range of images. Many candidates did include a photograph of their product. However, it would be beneficial if several photographs of the product were included in the folder showing different views, different angles and included close ups.

Unit A623 3B Strand 3

Candidates are expected to show, explain and justify that they have used a wide range of appropriate processes, materials, parts, components, tools and equipment. It is important that evidence is presented in the folder of the candidates using tools, equipment and processes as marks cannot be approved for witness statements. The information can be presented in a variety of formats, however good practice saw candidates presenting information as a log or diary of making. With the log including photographs for each stage and next to it columns that allowed tools, materials and equipment used to be included and explained. A final column referred to the production plan identifying and justifying changes that had been made, with sketches added when necessary to justify a point.

Unit A623 3B Strand 4

In this strand candidates are expected to show evidence that they have applied appropriate health and safety procedures. They should also appropriately apply, explain and justify a range of quality control checks that have been carried out during the production of their product. Health and safety procedures and quality control checks should be relevant and related to the product being made and not be presented in generic terms.

Good practice saw candidates using photographic images that supported health and safety issues and quality control checks. Detail was given as to what the quality control checks would be, how they would be carried out and why they were necessary. Health and safety issues were identified and how the user would be protected was explained. Evidence was presented showing that candidates had carried out or applied risk assessments on equipment to be used and explanations given as to why such procedures were necessary.

Unit A623 3B Strand 5

Candidates should detail and justify modifications that can made to the design solution. Sketches could be incorporated of a modified, and maybe more appropriate, solution with an explanation given as to why this would be so. Consideration could also be given as to why the use of modern materials, processes and technologies would be beneficial to the product and its production.

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Good practice was seen by candidates who evaluated their final product and went on to use diagrams and modelling in order to suggest and explain modifications that could be made. Such modifications not only considered how the design of the product could be improved but also considered alternative production methods and materials, the use of 21st century equipment and smart materials.

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A624 Impact of modern technologies on engineering

General Comments:

Most candidates attempted all of the questions on the paper but in some cases there was evidence of candidates not having read questions carefully before answering. It is most important that candidates take time to read through the question paper thoroughly before attempting to answer questions. This is particularly the case where questions have a very specific focus and require extended writing in the response, such as in Quality of Written Communication (QWC) questions.

Some of the responses to questions relating to engineering materials were quite disappointing, with knowledge of composites continuing to be rather limited. Candidates' knowledge of engineering processes was generally quite good, but there some confusion as to which category of process specific processes fitted into.

An improvement was seen in general knowledge of modern technologies, but understanding of their applications in an engineering context remains quite limited. Questions relating to energy usage and the environment were well answered in many cases, demonstrating an understanding of a number of the issues that exist.

Comments on Individual Questions:

Question No.

1(a) All candidates scored well on this question, with many gaining full marks. In many cases examples of products were those referenced in the specification, but some candidates chose to give more unusual examples, particularly for the 'Rail and Marine' sector.

1(b) Almost all candidates scored full marks for this question and the only instances of marks being lost occurred where candidates misread the question and had given examples of products rather than naming sectors.

2(a)(i) – (iv)
Most candidates scored well on these questions but in some cases responses appeared to have been chosen at random from the list provided. Some confusion between the different types of materials was apparent, with GRP occasionally being quoted as being a non-ferrous metal, and high carbon steel as a composite.

2(b)(i) This question was quite well answered in most cases, with copper and concrete being the most frequently chosen materials. Electric cable or wire was invariably the example product given for copper, and anything from roads to buildings appeared as examples of concrete products.

2(b)(ii) Most responses to this question gave relevant reasons for use of the chosen material in the product given, but in many cases simplistic statements such as 'tough' and 'hard' were made, and were often irrelevant to the example given.

2(c) Few candidates scored full marks on this question, normally due to the fact that simple lists of properties were given rather than factors to consider when selecting materials for products. Where this was the case, a single mark was awarded for the question overall.

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3 (i) All candidates attempted this question but very few scored well on it. Robots were frequently mentioned with regard to their use in packaging, as were barcodes in dispatch, but detailed explanations of their actual use were rarely seen. Most candidates scored either one or two of the three marks available for the question.

3 (ii) Responses to this question were quite similar in quality to those for part **(i)** but a number were too lacking in detail to score more than one or two of the three marks available for the question. CNC machines for manufacturing were a common theme, but very few candidates considered sensors for monitoring, or Computer Integrated Engineering.

4(a) This question was generally well answered, with some higher achieving candidates scoring maximum marks on it. The most frequently chosen components were the fuse, the resistor and the nyloc nut, although this was often simply referred to as a 'nut', forfeiting the mark for that part of the response. Some candidates attempted to give rather detailed descriptions of the uses of their chosen components, but simple relevant examples, such as the one given for component A, were sufficient to gain the mark.

4(b) Most candidates correctly gave pneumatics as the component type for a three-port valve, and only very occasionally did candidates offer mechanical as the response for this question.

5(a) This question was generally well answered, and most candidates scored at least three of the four marks available. Where marks were lost, this was normally as a result of some confusion between 'Heat and chemical treatment' and 'Surface finishing' processes, with galvanising and anodising quite frequently being given as examples of heat and chemical treatment.

5(b) Responses to both parts of this question were very varied, with some candidates scoring no marks at all while others gained all four marks available. In most cases robotics was the modern technology given as being used for both 'Joining and assembly' and 'Surface finishing' processes. This was perfectly acceptable, but marks were often lost as a result of the descriptions of use being weak or missing altogether.

6(a) Almost all candidates were able to determine that product A used the most energy overall.

6(b) This question was generally well answered, and a number of candidates scored full marks for two clear and justified responses. The most frequently quoted reasons referred to the size and/or weight of products and related this to the amount of fuel being used, and its effect on the environment. Distances travelled in the distribution of products was another popular example, while some of the higher achieving candidates also mentioned fuel efficiency in modern engines and aerodynamics of delivery vehicles as being energy saving factors.

6(c)(i) Most candidates were able to name a renewable energy source, with solar power and wind power being the most popular examples.

6(c)(ii) Only the higher achieving candidates scored full marks on this question as many responses took the form of rather simplistic statements rather than explanations. Benefits mentioned most often related to issues of environmental pollution or the depletion of fossil fuels.

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7(a) Responses to this question were quite varied and only the higher achieving candidates scored well on it. Recycling featured in many responses, as did fuel efficient / electric vehicles, with some candidates building on their comments in question 6(b) as part of their answers. Where marks were lost, this was normally as a result of responses being quite simple statements, with little or no real description.

7(b) This question was generally well answered and many candidates gave quite detailed and justified responses. In most cases, mention was made of the ease of separating component parts of products to enable recycling and disposal of waste materials, but a number of candidates lost marks by not giving the example asked for in the question.

8* Although all candidates attempted this question, many scored only half marks or less on it. Weaker responses often took the form of a list of the benefits of using CAD with no reference to any possible disadvantages and, in some cases, candidates moved away from the 'designing' focus of the question and went on to describe the use of CAM when making the products. A significant number of detailed responses were also seen, however, and there was evidence from many candidates of good understanding of the workings and benefits of CAD software.

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

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