RECOGNISING ACHIEVEMENT

GCSE

Design and Technology: Electronic and Control Systems

General Certificate of Secondary Education **J301**

General Certificate of Secondary Education (Short Course) **J041**

OCR Report to Centres

June 2012

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, OCR Nationals, 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

Overview

This report provides an overview of the work seen in the written examination Units 2 and 4 and the Controlled Assessment Units 1 and 3, for candidates who took the examination during this series. It precedes a more detailed report to centres from each subject area within the Innovator Suite and highlights general issues that have occurred across the suite of specifications.

This report has been prepared by the Chief Examiner, Assistant Chief Examiners, Principal Examiners and Principal Moderators and covers all specifications within the Innovator Suite. It should be read in conjunction with the examination papers, the mark schemes, and the marking criteria for assessment given in the specification booklets.

This is the second examination series in the third year for the new Innovator Suite.

A reminder: An important point for teachers to note about the Terminal Rule in relation to this suite of specifications and re-sits: The terminal rule is an Ofqual requirement. Candidates must be entered for at least two units out of the four (full course) at the time that they certificate. ie the end of the course.

Please be aware that the Ofqual rule states that marks scored for terminal units will be the marks used in the calculation of candidate grades. Therefore, if one of the candidate's terminal units is a re-sit and the mark is poorer than the original mark, the poorer mark will be used to calculate the final grade for that candidate.

Obviously, the terminal unit marks are then added to the highest marks scored in the other units making up the certificate.

Centres are reminded that it is also a requirement of Ofqual that candidates are now credited for their accurate use of spelling, punctuation and grammar across all four units.

It is pleasing to see that centres and candidates have continued to respond well to the new style of examination approach. Centres are to be commended for this.

It is obvious that Centres have benefitted from previous reports and training sessions available for the qualifications.

Written Examination – Units 2 and 4

Unit 2 – For this examination series of the GCSE Innovator suite entries were seen from all six subject specialisms.

The overall performance and range of results for Unit 2 was generally the same as seen in the last examination session – January 2012. It was pleasing to see that many candidates had been well prepared for the examination by Centres and clearly had a sufficient knowledge base to answer the questions. It has been encouraging to see that candidates have been able to access the higher marks.

In **Unit 2 – Section A** of the papers most candidates across the suite attempted to answer all questions, with few candidates giving no response (NR) answers. It was noticeable that, at times, candidates had not read the instructions correctly and centres would benefit from explaining the correct examination requirements to the candidates. Candidates need to be encouraged to give an answer for the multiple choice style questions even if they are uncertain that they are correct. Centres are reminded that questions 1–15 cover the grade range from A* to U.

There was less duplication of circling answers seen during this examination session.
Important: Centres need to be aware that where a candidate has provided multiple answers to a single response question, no marks will be awarded.

Unit 2 – Section B of the papers showed a greater mixture of responses and teachers need to ensure they read the subject specific reports for further detailed feedback on specific issues and individual question performance.

Important: Candidates need to be careful that they do not repeat the question in their answer or write the same answer for several questions. Similarly candidates must not use certain terms as 'stock' answers. Such answers included:

- 'Environmentally friendly' and 'better for the environment' or 'damages the environment'.
- To 'recycle' and 'recycling is good for the environment'.
- 'Cheaper', 'better' and 'stronger'.

The questions marked with an asterisk * provided candidates with an opportunity to give a detailed written answer combining good subject knowledge with an ability to produce a structured response. There has been a significant improvement in the written response style question this session, with candidates giving detailed answers combining good subject knowledge with a clear, structured response.

It was noticeable this session, that where extra paper was required to continue a question response, many candidates failed to reference the question number thus compromising marks. It is important therefore, that centres teach candidates how to highlight where they are continuing an answer on a different page in the examination document.

Centres are reminded that candidates are assessed on spelling, punctuation and grammar on the banded mark scheme question.

It is also important to note that candidates need to ensure that they write legibly and within the areas set out on the papers.

Unit 4 – For this examination series of the Innovator suite entries were seen from all six subject specialisms.

It was encouraging to see improvements in candidate performance across the Innovator suite this session. The following improvements were noted:

- Candidates appeared to be better prepared to 'tackle' the questions than in previous sessions.
- Candidates managed their time effectively, most attempted all of the questions and there were fewer No Response (NR) answers recorded.
- A better standard of response to the Quality of Written Communication questions was seen.
- More candidates demonstrated high levels of knowledge and understanding and were able to access the higher marks.

It was encouraging to see however, that most candidates demonstrated a good understanding of the technical aspects of designing and making across the specifications.

Important Note: Candidates need to:

- **Read through the complete question before attempting to answer**. The examination includes sufficient reading time for candidates to focus on the key points to address in their answers. It was pleasing to see that some candidates produced a 'plan of action' before giving their answer to the questions with a high mark allocation.

- **Look carefully at the mark allocation and available space for their answers**. Candidates need to be aware that there is a relationship between the space available and the length and quality of the expected answer, and thus the mark allocated.

- **Have a better understanding of the different command words used throughout the exam paper in order to respond appropriately to the questions.** Across the suite there were many answers that lacked detail and clarity. Terms such as 'cheaper', 'quicker' and 'easier' were often used and meant very little without qualification or justification.

- **Become familiar with the quality of written communication questions marked with an asterisk***. These questions provide candidates with the opportunity to give detailed written answers combining good subject knowledge with an ability to produce structured, **coherent** responses and accurate spelling. Simply repeating the same point several times will not lead to the award of marks. A list of bullet points does not represent an adequate answer and will compromise the higher marks. Practice of this type of question which carries [6] marks is strongly recommended.

- **Respond to specification and/or bullet points accurately.** In design type questions this is important if the candidate is to achieve the maximum marks available.

- **Make sketches large and clear enough to convey meaning**. It is equally important that notes should be clearly written and reinforce what appears in the sketches.

- **Make their answers clear and technically accurate**. In questions that require candidates to produce sketches and notes, it is essential that answers are made as clear and technically accurate as possible. Marks may be compromised through illegible handwriting and poor quality sketches.

Controlled Assessment – Units 1 and 3

This examination series has seen portfolios for all subject specialisms being submitted for Unit 1 and Unit 3 both through postal and repository pathways. Most centres have been prompt in the dispatch of documentation to OCR and moderators, which is to be commended. **It is important that Centres return the request for portfolios within three days.**

Centres are reminded to forward form CCS160 in particular to moderators. It is helpful if centres also include a record of the marks allocated to each candidate, for each of the marking criteria sections.

Important Note: Candidates producing paper portfolios should be entered for postal (02) moderation. Candidates producing their portfolio on a CD or memory stick should also be entered for postal (02) moderation.

Centres must ensure that if candidates are entered through the repository (01), the portfolios must be uploaded via Interchange and **NOT** sent through to the moderator on a disc. The preferred format of files presented for this type of moderation needs to be PowerPoint, PDF or Word, with work saved in ONE file only and numbered, not as individual sheets saved in different files.

In general, Centres have been successful in applying the marking criteria for both Units 1 and 3. Centres are reminded to apply the mark scheme on a 'best fit' basis which may mean allocating marks across the assessment grid. Marks should be positive, rewarding achievement rather than penalising failure or omissions.

It was still evident that a significant number of portfolios, particularly for Unit 1, resembled the legacy format, especially in terms of the excessive research and inappropriate critical evaluation.

It is important that centres encourage candidates to organise the portfolio according to the different marking criteria strands as it enables the candidates to produce work that clearly shows an understanding of the controlled assessment requirements. Portfolios should be clearly labelled with the Candidate and Centre name and number, with the unit code and title also evident. (*Specification – 5.3.5 Presentation of work)* This is particularly important when the Centre submits work via the OCR Repository, where individual files are used to store portfolio work. Centres need to ensure that candidates clearly label each file using the marking criteria section headings; this facilitates a more effective completion of the moderation process.

Important: Centres are also reminded to ensure that the OCR cover sheet is included with each portfolio of work, **outlining the theme and the starting point chosen by the candidate.**

JCQ documentation on Controlled Assessment (September 2011 – August 2012) clearly states that any guidance given to candidates must be clearly recorded. *4.5.2 When marking the work, teachers/assessors **must not** give credit in regard to any additional assistance given to candidates beyond that which is described in the specification and **must** give details of any additional assistance on the appropriate record form(s).**This includes providing writing frames specific to the task.** (eg outlines, paragraph headings or section headings).*

In light of the information given above, Centres need to take care when using writing frames in the controlled assessment portfolios.

Many candidates included a bibliography or referenced their research sources, which was pleasing to see. **It is good practice to ensure that candidates acknowledge sources of information used for the development of their portfolio work**. *5.3.2 Definitions of the Controls* section in the specification states: *"The teacher must be able to authenticate the work and insist on acknowledgement and referencing of any sources used".*

Centres are to be reminded that the '*controlled assessment task must NOT be used as practice material and then as the actual live assessment material. Centres should devise their own practice material using the OCR specimen controlled assessment task as guidance.*' *Specification – Section 5.2.2 Using Controlled Assessment Tasks.*

Resits – Centres must remember that the theme, starting point and research aspects of the portfolio can be maintained. However, the remaining portfolio and final prototype should be redeveloped for submission.

It is a requirement in the Making criteria that candidates *"demonstrate an understanding and ability in solving technical problems".* **Centres must therefore ensure that problems encountered are written into the record of making, for the higher marks.**

4.1 'Schemes of Assessment' clearly states that *"A Minimum of two digital images/photographs of the final product showing front and back views"* should be evident in the candidate portfolio. **It is the centre's responsibility to ensure that photographs are evident, are of a good quality and are of the candidate's own work**.

A511 Introduction to Designing and Making

Comments

There has been a steady improvement in the quality of projects completed over the previous year with most centres showing an improved understanding of the assessment criteria. The range of electronic control systems varied from barely above Key Stage 3 to complex multi process prototypes. PIC solutions have increased but it brings with it the problem of discerning what the candidate has completed for themselves. Evidence of making is still a problem and some photographs of the final prototype have been poor. It is the responsibility of the centre to ensure these pictures are of sufficient quality to demonstrate the making standard. Delays can happen when centres' are asked for better pictures. Some centres still deliver the coursework as taught materials with all candidates carrying out the same project, using the same design work, selecting the same circuit and then making the same prototype. Consequently candidate reports are very similar, which makes it difficult for candidates to gain marks in creativity.

Creativity

In the initial stages of the portfolio candidates from many centres are adopting a mind map to show the connection to the theme. Since this is a controlled assessment, centres must work from given themes in the appendix of the specification.

Candidates have many approaches for gathering information around the chosen theme, interviews are certainly the best. Some questionnaires are still seen but do not gather specific information around the theme selected.

Research of similar products does show the candidates' thinking but rarely goes on to look at the technologies used or the changes in good design. Products chosen should have a control system content which would allow candidates to comment on these points. There have been many random products which do not relate to the theme this series.

Design briefs are usually well done with clear information on the need and problem. On many occasions the next step is an action plan with the 5W's.

When carrying out a product analysis few candidates were able to disassemble a product and have firsthand experience of that product. This is the foundation of considering their own design response.

Successful candidates clearly connected to the set theme and established the client group. A mood board showed thinking around products and situations. Discussion about similar products will help to describe the technologies used and contrast between products. The quality of the design will be considered by how the product fits the need and functions of the user. The design brief clearly showed the link to the user and needs for the situation. Product analysis is a stepping stone to considering design and construction of the prototype.

Information is gathered to help the specification, such as size data, specific needs and specific components. A conclusion highlights important points.

Designing

Specifications were varied, but many contained a general list and used centre headings. Candidates missed specific points of function and used general points which could have been for any product. Many centres have adopted the system approach at the start of ideas, by either listing components under these headings or using blocks to create a system. It is a useful style which leads to increased detail for each idea. For electronics there has been a great reliance on library sources, which can be used so long as the source is acknowledged, but candidates should go on to describe in detail how the system functions and meets the need.

Explanations were missing in many cases, giving a diagram with minimum comments. It is vital candidates use their technology knowledge to describe the function and later the modifications in development.

Selections from the ideas should be based on the need of the users not just on whether the candidate thinks they can make the prototype.

Modelling should be used to improve the initial selected idea into a final design. It is not sufficient to simply redraw the same system. Improvements and modifications are expected to bring the system nearer to the needs of the user. Component or virtual modelling should have good quality comments on these improvements.

In a final design full details are expected before manufacturing can take place which would include a component list.

Successful candidates used system block approaches and discussions before producing ideas. The ideas produced had very clear notes which described the functions and how they fit the user needs. Selections took place after a discussion of the good points of each design then; showed a sketched final idea before development.

Further modelling improved the final idea to make it better match the needs of the user. Clear notes showed the line of thinking on the modifications. A final design will include full details of the construction eg PCB mask, components, structure sizes.

Making

Candidates are expected to plan and organise the making process, therefore the starting point should be a manufacturing plan. Most centres used a grid plan to show all the stages against materials, tools, machinery and quality check points. The stages need to be sufficiently broken down to thoroughly describe construction and assembly of the system.

Most centres made prototype products of a high standard. It is clear candidates enjoy the making processes. Since moderators are removed from the final outcomes it would be useful to have a statement of the working ability of the prototype system.

Where centre staff have intervened in the construction of the prototype, for example making the pcb or operating the laser cutter, it would be useful to know when the candidate takes over the making process again.

Where PIC chips are used with general PCBs much more emphasis must be made on the programming detail and how the program is assembled.

Solving Technical Problems

Even the most successful candidate will make modifications and improvements during the making stage. It is vital all the information is captured on a snag or improvement sheet. Candidates need to demonstrate the problem and how they overcame the difficulty.

Record Key Stages

We are now seeing some very successful records of the key stages of making the prototype. Photographs are used with good clear comments of the stages. The breakdown of parts in the assembly of the system is still being skimmed over and would benefit from more detailed pictures. A very good record of making gives confidence in awarding the Making mark.

Successful candidates had a very detailed construction plan with all the stages clearly set out. They considered all the tools and equipment needed and recognised the quality check stages for a successful prototype. The quality points had been incorporated in the solving of technical problems. Skill and quality have been demonstrated in the construction stages and photographs have been taken of all the stages, with the name clear on each picture. The prototype functions successfully because modifications have been made along the way.

Critical Evaluation

There are still too many candidates using the specification as the basis for the evaluation. If candidates start with the manufacturing planning chart and either add to the chart or use it as a basis for an evaluation, a better report will result.

Comments are needed on the modelling stages and production stages in order to suggest improvements and alternatives. Simple testing for functionality can then be used to report how the needs of the user are met. Candidates have been constructing a prototype therefore comments for improvement and modifications should flow easily.

Successful candidates were able to review the stages of modelling and construction in an analytical way to appreciate the improvements that could be made. Comments made on the modifications reflected on the improvements the prototype would need to make it a successful product. Successful candidates used the correct technical language and organised the folders in a logical way which allowed a flow through the whole process.

A512 Sustainable Design

The large number of entries seen last summer continued this year with well-prepared candidates able to access the full mark range. Most candidates were capable of achieving marks over a wide range of questions. There was little evidence of candidates running out of time or being unable to attempt the majority of questions. It was disappointing that some candidates were clearly not reading the question fully eg failure to mention moral issues in Q18 (d).The legibility of candidate responses was noticeably improved on previous sessions although a number of candidates still used pens which 'bled though' the paper and a small minority produced responses that were extremely difficult to read. Most of the very low scores were from candidates who did not attempt the majority of the paper. Weaker candidates were prone to repeating the question especially if several lines were available for their answer. In the 6 mark written response they tended to repeat early statements or paragraphs, sometimes word for word, sometimes rephrased.

Questions 1–15 (Section A) consisted of 1-mark responses and they were generally well answered with very few nil response.

1 Fitting double glazing to a house – b – Reduces heat loss to surroundings, – well answered.

2 Fair-trade logo – d – Fair-trade, – well answered.

3 Product life cycle is about – c – Considering the impact of a product on the environment, – well answered.

4 Burning natural gas to provide heating – b – Contributes to global warming, – this was often answered with d, candidates possibly assuming the 'natural' part was sustainable.

5 Wind-up electronic products – a – Help save the planets resources, well answered

6 The correct longhand of COSHH was very poorly known, although several got close with 'humans' in place of 'health'. A variety of ingenious word associations/sequences, some of them loosely related to the actual terms were offered.

7 The term non-biodegradable was very well answered in a variety of appropriate responses.

8 A variety of toxic and harmful substances were correctly stated with lead being the most common.

9 Aesthetics was recognised as the correct term and examiners accepted a wide variety of spellings.

10 'Repair' was selected by a good majority.

11 The majority of candidates understood the term eco-design.

12 Hydro-electric power was understood not to contribute to global warming.

13 The science of anthropometrics was well known.

14 Solar electric panels were understood as contributing to sustainability.

15 LED light bulbs were well-known to offer a long service life.

16 **(a)** **(i)** Virtually all candidates recognised that a language change was needed but didn't always qualify it. Changing symbols 'for other cultures' was mentioned. A small proportion demonstrated a lack of understanding of other cultures suggesting the product would need to be simplified.

(ii) There were many vague answers referring to the working environment (eg temperature or space) rather than working hours, health & safety, minimum wage and child labour.

(b) **(i)** The majority of candidates gave a good reason, gaining the mark.

(ii) There were many good responses indicating a familiarity with the functional advantage of touch screen products, most achieving at least 2 marks, but generally the explanations backing up the advantages were weak, implausible or factually incorrect. Perhaps even though students use touch screens they have not considered the revolution.

(c) Most responses related using 'less paper' to 'saving more trees/animals/habitats' but then struggled for extra marks, giving vague reasons like 'less landfill' or repeating their initial explanation using slightly different words. The better candidates recognised the transport/packaging issues and gained full marks.

(d) A surprisingly poor response to this question – apart from those who had been taught a definition. The majority wrote about 'carbon used' rather than 'carbon dioxide produced as a result of....'

17 **(a)** **(i)** Well answered by most candidates.

(ii) Appropriate recycling of the glass element with a good number mentioning '...specialist' in their answer. Some suggested re-using the electronic components for new lamps.

(iii) Mercury was reasonably well known as the metal, a wide variety of other metals (and some non-metals and gases) were offered many of them not harmful and in regular use (aluminium and copper were popular).

(iv) There were some good responses – mostly relating to energy costs or savings from reduced energy consumption. Only a few mentioned savings in maintenance/transport/old products/new lamps and a number mentioned 'improved light' which was not what the question asked. 'Less energy' could perhaps be explained on a wider basis involving not just cost but less CO2, seeking alternative sources of energy and making better use of the energy we do use.

(b) Given the media coverage of this topic the response to this question was generally poor. Many candidates had little idea what happens in these developing countries and seem to have a low opinion of them – not realising at all the unethical practises of companies in the UK and Europe are the driving force behind the scheme. Many thought the population could somehow be educated by having these products that they could 'repair and reuse' or 'become better trained at...' or miss-read the stem to include electrical (rather than electronic) products.

(c) Rather a poor response, with lots of vague answers relating to CO2 reduction, not offsetting. Sourcing or using green energy was frequently mentioned but rarely was the investment in green energy. Those who had learnt the definition gave a good answer.

18 **(a)** **(i)** Generally well answered but some thought that not covering the whole of the product saved material and that this was an environmental benefit. A good number mentioned that trapping air would save material or that it used a harmless filler. A number of responses included 'recyclable' or 'reusable', often as the second reason, rather than thinking a little deeper.

(ii) Well answered showing that candidates link plastics manufacture with the consumption of fossil fuels.

(b) **(i)** Generally well-answered although a significant number conveniently forgot to consider the word 'sustainable' and then found it difficult to answer part (ii) adequately. The planting of 'additional trees' and the 'habitats for wildlife' provided by these trees were popular explanations but the wider issue of sustainability remains poorly understood.

(c) Some good responses with a mix of drawings/logos (real or imaginary) and notes or 'environmental' statements. Drawing quality was generally poor. A good number of candidates included 'standards' that did not relate to an environmentally friendly aspect of the product, and others missed an opportunity to use their imagination to gain some marks.

(d)* This written response question produced a good number of well-reasoned answers that addressed the issues raised in the question. Weaker candidates tended towards repetition but many managed mention of built-in obsolescence. Most realised the extra cost to customers and the environmental costs of increased production and waste disposal, but moral issues were generally weakly argued or missed completely. A surprising number argued in favour of the companies, claiming the practice saved jobs and if they didn't do it the companies would 'go bust'. The 'use of electronics' in the cartridge confused some candidates but those who understood did well, with able candidates finding space to consider both sides of the coin, mentioning the potential for harm that consumers might conceivably face during the refilling process or the damage that might be caused to the printer if refilling is completed incorrectly. Some even went so far as to suggest a boycott of companies that flout the 6Rs or that 'customers will ultimately suffer'.

A513 Making Quality Products

Comments

Candidates have been finding it difficult to keep the amount of work within 20 hours, certainly most designing sections are too lengthy for the marks available. Photographic evidence of the final product has been very mixed, it is difficult to demonstrate the quality of the product with a few out of focus photographs. It is the centre's responsibility to ensure these pictures really 'sell' the product, low ability candidates are not always capable of producing good quality photographs. Centres need to respond quickly to requests from moderators for further information, the moderation period is tight and delays could cause results to be delayed.

Designing

This unit stands clear from A511 and should have no connections with data, designs or construction. The first section of designing should consist of no more than five sheets. The theme should link from the mind map to research into the situation and need of the user. Design briefs were mostly well written, although some centres made them very general, if they are not focussed the research and information gathered can be too general. A summary of all the points which are important for the user should lead to a clear specification. This is sometimes split for the system function and the container or structure. Centres must not use general headings, such as the 6Rs. All the above points are for 4 marks, therefore, the design brief needs to be compact.

Proposals for ideas need to have a system basis but the style presenting these can be varied. Most centres still produce on average three ideas and make selections. The alternative approach beginning to be seen is to start with one idea and develop in stages to the final idea. For either method, clear comments are needed to describe the function of the system. There is a danger of picking complex systems from a library and not fully understanding how they work or worse still just repeating the comments found on the page which are clearly not the words of the candidate.

Complex 'found' ideas lead to projects which are rarely completed and have problems which candidates cannot fault find.

The case or structure was sometimes shown in a sketch form; this makes understanding difficult. Google SketchUp is being seen more as a quick method of visualising the structure, whilst the outside and shape are being shown and discussed, rarely is this true for the inside fixings for the system.

Centres must remember the type of course candidates are engaged in, where the system is the most important aspect of the design activity. We are still seeing very simple systems, with candidates spending too much time on the casing, candidates must demonstrate knowledge of technology systems at GCSE level. Selection and modelling should take place for the whole product, improvements are expected from the basic ideas to better fit the user and function required. The final design should be the best possible at the time of completing the folder work, with full working drawings, which should leave no doubt about the product to be constructed including all sizes and a component list.

Successful candidates showed a connection to the theme with a mind map which was developed to show a number of possible product areas. There was research to show the user and needs, the design brief was clearly indicated and how the needs of the user were satisfied. Data and information was collected about the problem leading to bullet points in a summary. The specification was written to include the function of the system and the product casing or

structure. The style of headings created measureable points to be used in the evaluation. Ideas for the system had comments which showed good technical understanding. Selection comments included the user and led to the final idea. Modelling improved the final idea and a discussion told what was being achieved. There was a PCB and component list making clear the future construction. The casing ideas were clear, showing how all the external parts fit, notes explained how it all worked. Appraisals of each idea led through to the final sketch which was simply modelled. There was good quality information showing how all the parts fitted together, including internal detail and a working drawing which gave all the information for construction.

Making

The plan for production was often seen in parts for the system and structure. The breakdown of all the stages is important in order to demonstrate the candidate has a full understanding of the product construction. Columns should include materials, equipment, quality checks and time. The detail in the plan is often a measure of what the candidate will put into the quality of construction, because it shows they have clearly thought through the process. When the candidate has divided their time well some very good quality products are constructed; as a result real care is shown when making the final assembly of the systems and structure and centres can award marks with confidence. Some centres have been awarding high marks when products are unfinished for example; loose PCBs, batteries not in the case and switches not fitted. In most cases wire routing is not thought about and just randomly pushed in. Where there have been difficulties in construction centres should fill in the comment section of the cover sheet. When moderating remotely the function of the product has to be judged from the pictures therefore it would be useful to have a teacher comment on the efficiency of the system and product.

Solving Technical Problems

Candidates need to record in detail all the technical problems they have met and how these have been corrected. Centres need to set up a method to ensure this information is captured. Some centres have shown a whole class approach to this with very general problems of soldering and components placement, candidates must take ownership and record these actual points.

Record Key Stages

The record should be extensive and needs to include the system, the structure and the fitting of parts. Too often many stages have been missed and high marks have still been awarded. A good commentary is required to describe the images, whilst certain library images can be used from the PCB onward they should be unique with the correct name on each one.

Successful candidates developed a very detailed production plan covering all the stages, often in two parts for the system and casing. It is clear candidates have thought about the construction stages and are in control of the work. Many candidates have been able to schedule their processes showing skill and applying their knowledge. Product sections were tested and improved to ensure the whole product is finished to a high standard and will function as intended. The problems, improvements and modifications are logged to show how the candidates overcame each step. Photographs or sketches are used with notes. The key stages of the construction processes are photographed, with candidate names and comments added to explain the image. It is all arranged in a logical order showing unique parts of the work.

Evaluation

Specification checks on the whole are well carried out. At the middle and lower ability statements ‘it met the spec’ do not inform whether the product is really working.

Testing comments were rare; candidates should carry out effective checking on the function of the product. Modification and improvement comments can only be based on real testing of function, matching performance to the need of the typical use. Pictures and videos were seen demonstrating the product in use.

Successful candidates used the specification points to head up discussion points about the success of the product design and manufacture, they used real testing with the users, reporting comments and making conclusions on the effectiveness of the product. They reflected on the performance and proposed improvements and modifications for the next stage of development of the prototype.

A514A 01 Electronics Paper

Results this year showed some improvement in the way that the paper was tackled; there were fewer 'no response' answers and very few candidates did not complete the paper. It was apparent though that a significant number of candidates had not read or comprehended the instructions before attempting a response. The stem of each question gives information about the question and about the context, if it is ignored vital information may be missed. Candidates should be made aware that repeating a point, either one that has been made by them or a point from the question will not gain any marks.

Areas such as breadboarding, which at one time were critical in the development of electronics, appear to have been abandoned in favour of simulation software by students. There is still a strong case for much of the theoretical knowledge to be gained through practical 'hands on' experience. Key concepts such as the relationship between resistance, current and voltage should be reinforced at every opportunity; use of multimeters and other test equipment should be a part of all controlled assessment work. It is also beneficial for candidates to see and handle different types of the same component eg capacitors which are available as electrolytic, ceramic, polyester and tantalum. Resistors can be fixed, preset horizontal, preset vertical or potentiometers.

In the questions testing quality of written communication it was pleasing to note the lack of bullet point lists; however there are still very few examples being brought into the discussion. In the question on the benefits and drawbacks of batteries there were many examples that candidates could have used to illustrate points made.

Section A

1 (a) (i) The majority of candidates gained a mark for this opening question by correctly identifying the recess as a means of preventing accidental resetting of the device. There were a few candidates who had confused the words 'recess' and 'reset'. Candidates should be advised to read all questions thoroughly.

(ii) Those candidates who were familiar with block diagrams or flow diagrams correctly identified the feedback elements in the system. There was a significant minority who clearly had no idea of what feedback was or where it could be found on the diagram.

(iii) Knowledge of LCD displays was generally good, probably as nearly all candidates will be using a mobile phone regularly. The benefits were well known, though drawbacks frequently related to initial cost of the screen or replacement of it when broken. The better candidates identified difficulty of viewing in bright conditions.

(b) (i) The majority of candidates gained at least one mark for recognising that the pickups would make contact with the sensor wheel when the wheel is rotated. Far fewer mentioned that the contact would then be broken again as the wheel moves round. The most able candidates noted that the on/off switching would generate a pulse.

(ii) The most common response for the type of signal generated was 'digital', very few candidates mentioned an astable signal. Those who failed to gain the mark had often identified the signal as 'analogue' or 'kinetic'.

(iii) This question was well answered; copper and aluminium were the most frequent responses though there were a minority who had incorrectly chosen steel. Although aluminium is not ideal for this application it could have been used successfully.

(iv) Properties that were accepted as correct had to be relevant to the use of the material, the most common response relating to the ability to conduct electricity. Those who had said that the material could be easily bent into shape or in the case of aluminium, had a low cost were allowed the mark.

(c) This part was generally not well answered although it did provide clear discrimination between candidates. More able candidates gained marks by noting that there were fewer parts that would be affected by wear or that lack of physical contact would allow the wheel to run more freely. Those who referred to cost or fewer parts were not given a mark.

2 (a) (i) In recent years it appears that fewer candidates are familiar with the operation of a multimeter, particularly in terms of reading resistance. Those who were familiar with the multimeter stated that there was no resistance; others mentioned breaks in the track, faulty soldering or lack of voltage or power. The question clearly stated that the test was being carried out on a newly made PCB; this was another instance of where candidates would have benefited from careful reading of the question.

(ii) Following on from the previous part, suggestions that there was no voltage or no current in the circuit board reflected that the candidate had not fully read the question. There was a significant minority of candidates who thought that a break in the track would cause a reading of 000.0. Candidates should all have the opportunity to use multimeters on a range of settings as part of their controlled assessment. Reliance on simulated tests on PCB development software will not give the same experience.

(b) Almost all candidates scored well on this question; the few errors were mainly centred on mistaking the laser hazard symbol for electric shock.

(c)* Examiners found a general improvement in the quality of written communication compared to the last session. This question centred on specific threats to health and safety; in many cases the responses were limited to a mark in the level 2 range due to a lack of relevant facts. There was a tendency for candidates to concentrate on personal protective equipment rather than addressing the more specific threats from the new materials and techniques that were mentioned in the question. More able candidates did mention the statutory duties of employers in protecting their workers.

3 (a) The more able candidates had a clear idea of why transistors are used in a circuit, others appeared confused on the reasons for use; in some cases the candidate was clearly describing the purpose of a resistor.

(b) (i) Very few candidates were capable of completing all of the Darlington pair connections correctly. The base to emitter connection was the one that generally gained marks. There were very few examples where the two collectors had been joined or the second emitter had been connected to 0V.

(ii) Drawings of the diode varied in standard, it was noted that many candidates did not have a clear idea of the correct symbol. Those who had drawn the symbol correctly had often connected the diode incorrectly. To gain both marks the diode had to be in reverse bias and connected across the solenoid terminals or from collector to positive rail.

(iii) This part of the question discriminated well across the ability range; most candidates gained at least one mark for labelling the base connection.

(c) This question gave a choice of method and required advantages to be given for the chosen method. Answers were in most cases quite clear and except for those who gave cost as a reason or repeated the information given in the question at least one mark was gained.

(d) A number of candidates did not appreciate either the nature of transistors being developed for nanotechnology or their potential applications. However marks were awarded for benefits that reflected the potential reduction in size of circuits as well as the savings in energy. Candidates should be advised that no marks are awarded for repeating what is in the stem of the question.

Section B

4 (a) Notes and sketches were used effectively by the majority of candidates. The secure connection of the cable should have included a grommet or a method of strain relief along with a clear description of the intended method of use. A number of responses included instructions on soldering; others had used the preset potentiometer as a cable clamp. The best solutions used simple methods such as threading the separated cable through two holes before soldering or using a cable tie or knot in the cable to prevent it being pulled out.

(b) The more able candidates knew that a diode can be used to prevent damage from an incorrect connection; there was however a significant number of responses which included seemingly random connections and gained no marks.

(c) This question was generally not answered well. In some cases there was clear advice mentioned but it was not in the form of an instruction to an assembly worker; benefit of the doubt was given in these cases but it is another instance of where the question was not read carefully. It was evident that the use of ribbon cables was not known to a number of candidates. This is one of the connecting methods appearing in ‘construction techniques’ in the specification.

(d)* The question on battery use brought out some very good responses; it was an area that all candidates were familiar with and led to confident descriptions of the benefits and drawbacks of battery use. It would be beneficial for responses to include examples rather than making very general points. There were two examples given in the question that could have been expanded on.

5 (a) (i) This question was well answered and very few candidates failed to gain the mark.

(ii) The more able candidates or those who had actually made a counting device appeared to understand the need for debouncing. In many cases though there was not any clear understanding of what causes switch bounce or why it must be prevented.

(iii) This question highlighted the fact that many candidates now seem unfamiliar with the use of a physical breadboard. Although many tests can be carried out using simulated circuits it should still be a part of the candidate's development to assemble a breadboard in a logical manner. In this case the incorrectly connected 10K resistor lead was spotted by far more candidates than the LED connected the wrong way round. A number of candidates gave a missing capacitor as a fault, not recognising the 47n capacitor that was clearly visible on the breadboard.

(b) (i) There were some good attempts at completing the PCB layout, odd routes for the tracks were chosen on occasions but any functional layout was rewarded.

(ii) In approximately half of the responses a marker for pin 1 was correctly placed. It should be noted that those who drew the top outline of an IC with the semicircle in the centre did not get a mark as they had identified pin 1 end of the IC but not distinguished between pins 1 and 14.

(iii) Reasons for having wide tracks were correctly identified by about 50% of candidates.

(c) This question was not well answered; there were a number of responses that showed the reset pins joined but very few that went on to provide a 0V connection through a resistor and a switch to take the reset pins high. The use of pull up and pull down resistors is essential in digital circuits; this is another instance of where practical breadboarding should be carried out.

A514C 03 Mechanisms Paper

General Comments

Many candidates had clearly been very well prepared for this summer's examination with a pleasing number scoring very high marks. Most candidates attempted all the questions although a surprising number made no attempt at either of the 6 mark written response questions. However a number of candidates, who did attempt it, scored full marks on these questions with detailed in-depth answers that covered all the required points.

All candidates seemed to have sufficient time to complete the paper and even weak candidates felt able to attempt most parts of all the questions.

1 (a) (i) The vast majority of candidates correctly identified the worm and worm wheel, although weaker candidates sometimes suggested an incorrect range of gears from their knowledge.

(ii) At least one benefit of the mechanism was identified by most candidates, with the most able giving two often 'textbook' answers.

(iii) The purpose of the retaining nut and bolt was well known.

(b) (i) 'Lubrication' was the most popular answer with 'cooling and prevents corrosion' being close seconds. Weaker candidates tended to re-state the purpose of lubrication by saying 'to reduce friction'. Re-phrasing the same information did not score the second mark.

(ii) The use of a drip feed was well explained with answers including 'slow but steady' and 'saves doing it manually' popular along with 'does not flood the engine'.

(c) (i) Most candidates scored well on this question when they had some knowledge of material suitability rather than just listing known materials. The most common cause of lost marks was the suggestion of steel for the maker's nameplate and generic 'wood' (and MDF) for the display base.

(ii) The technical term for part X was poorly answered with a number of odd combinations with 'crank arm' being particularly popular, possibly derived from looking at bicycle diagrams. First-hand knowledge derived from actual machines would be ideal, but diagrams in textbooks and simulations on software such as the free www.technologystudent.com come a close second.

2 (a) (i) Rack and pinion was well known by most candidates although the spelling was not.

(ii) The action of the mechanism was a little more challenging but a variety of phrases were accepted with many candidates using the correct technical terms.

(iii) The motion of the relevant parts was well-answered by all but the weakest of candidates, possibly reflecting the benefits of dismantling simple mechanisms to see what is inside and how they work, a valuable activity for aiding understanding. Weaker candidates often gained marks from correctly relating movement between gears B & C.

(b) **(i)** The ratchet (or ratchet and pawl, frequently spelt as 'paul') mechanism was well known.

(ii) Candidates found describing the action in the mechanism shown challenging. Able candidates provided a textbook answer including details of what effect clockwise and anticlockwise rotation would have. A number of candidates thought that movement would be prevented in one direction, perhaps remembering something like a ratchet strap mechanism.

(iii) Flywheel action had a variety of responses with a number managing to include the words 'store' and 'energy' or equivalent. It was also described as being capable of a variety of other actions, none of which earned any marks.

3 **(a)** **(i)** Not as well answered as rack and pinion which is perhaps surprising. A good number of candidates scored 1 mark generally for 'rotary'.

(ii) Identifying the throw of the crankpin was beyond 75% of the candidates although indicating the direction of travel of part A (iii) achieved a much higher success rate.

(b) A good number of candidates were able to complete the calculation correctly, a marked improvement on previous examinations, but as previously, a significant number found ingenious ways of manoeuvring the numbers to no benefit, including taking numbers from different questions.

(c)* The written response was well answered with a good number achieving full marks with well written answers packed with real information.

Section B

4 **(a)** **(i)** The benefits of a toothed belt were well known with 'good torque handling' and 'timing' being stated as popular benefits.

(ii) The reasons for regular replacements were diverse and in some cases quoted from the problems of conventional V belts rather than specific to toothed belts. Generic statements like 'becomes loose' and 'wears' are not particularly strong answers in relation to a toothed belt.

(iii) Well answered with the benefits of chain drive mostly given as 'longer service life' and 'greater reliability'.

(b) Viscosity was occasionally used to describe the behaviour of oil vs. grease with the majority of candidates managing a mark with a valid reason.

(c)* This written response question produced an interesting range of answers across the ability range, with the most able including comments about sustainability, built-in obsolescence and the health and safety implications of attempting self-repair. As with the earlier question, a good number achieved full marks with well written answers addressing the key points.

5 **(a)** **(i)** The majority of candidates were able to answer this question at least in part. The most popular solution was by drawing two belt drives with the right hand one crossed over. Others used a gear based solution, generally adding an idler gear as required to ensure correct rotation. Some of these answers were accompanied by excellent notes annotating their sketches. A number chose to draw the mechanism separately as a front elevation to ensure total clarity.

A small number of weaker candidates used impossible or wholly unsuitable/non-functional drive systems and rarely achieved marks for a workable, or part-workable system.

(ii) Candidates made a good attempt at this question, many explaining the benefits in terms of speed, simplicity and the ability to check functionality without building a full-size prototype. The top candidates often added information about simulating the forces in the mechanism and being able to optimise them based on materials choice.

(b) **(i)** The basic properties of smart materials was were fairly well answered with the majority of candidates able to link a change of properties of the material with a change in the materials environment.

(ii) The table was attempted by most candidates with a spread of answers. Very few candidates scored zero but the properties and behaviour of the two materials was not universally known.

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