OCR
Oxford Cambridge and RSA

GCSE

Design and Technology: Electronic and Control systems

General Certificate of Secondary Education **J301**

OCR Report to Centres June 2017

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

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

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

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A511 Introduction to Designing and Making

General Comments:

As we move towards the end of this Specification, it is good to see that most Centres are familiar with the requirements of this controlled assessment unit and there were few problems this year with regard to completion of the appropriate assessment forms. Few Centres needed to be contacted to chase up missing work or documentation.

There were some issues with Controlled Assessment work becoming 'lost in transit; or lost at the Centre itself. It is essential that all work is clearly marked with Centre Number, Candidate Name, Candidate number and Unit number. This particularly applies to candidates who presented work in A4 card folders. In some cases the folders were worn through use and made identification of the work difficult.

The majority of centres are to be congratulated on the quality of the annotation, recorded on the work of individual candidates. Moderators of this unit appreciate the time and effort that teachers put into completing this task. However, the application of the mark scheme is far more consistent when teachers fully justify the awarding of marks. There should be a clear indication of why candidates deserve the mark. When the paperwork shows a lack of evidence, the centre marks often need adjustment to bring the marks in line with the agreed standards.

Some Centres did not attempt the justification of marks

Centres should take note of the Unit Specification, which clearly indicates that a 'best fit' approach should be utilised when marking work. Candidates work can be judged as basic, sound or high ability.

It is important that candidate responses are concise and completely relevant to the chosen theme.

The vast majority of the coursework seen during the moderation was relevant to a GCSE standard. However, Centres are reminded that in this unit, a candidate needs to produce a prototype system, not a product.

There needs to be a greater emphasis on the control of the proposed system and specific reference made to the manufacture of a 'prototype system'

In this unit the production of a case or container does not gain credit and is unnecessary.

Many students are still not considering sustainable design, materials, production methods or control systems in their analysis of existing products. This leads to inconsistent marking. There was no product disassembly in many candidates work – just a basic existing products analysis which lacked any depth.

Some centres are spoon feeding the same circuits to their candidates, who then all pick the same one to make, leading to almost identical outcomes, yet are still giving high marks in the designing section.

Evaluation/discussion of proposals often is unrelated to the design need. In some centres candidates only considered one circuit and just showed a basic development of the PCB

Specific Comments on:
Creativity
Most Centres used the set themes provided by OCR, to identify a suitable need and user group. There continues to be good use of Mind Map's and Mood Boards, to quickly identify a suitable problem.

It is important that candidates do not produce a detailed Design Brief at this point, containing all the features of the 'Final Design' Some candidates list all components and features – before actually designing the prototype system.

Centres are given clear advice on product analysis as part of the individual Centre report.

A generic recognition of similar products should be followed by a comparison of products, with a disassembly of an existing product. It is disappointing to see some Centres continue to ignore previous reports, giving advice on this issue.

Candidates should consider the sustainability of a product in detail. There were good examples of using the 6R's and good examples of using an 'eco-web' but there was little evidence of forming conclusions and showing the impact this has in relation to the product being analysed.

It is important that the consideration of sustainability is relevant to the product being analysed and is shown to be relevant to the chosen task

Similar to previous years, conclusions to the research continue to be lacking in detail and are often completed as an 'afterthought'. The conclusions need to bring all of the research activity together and form the basis for producing a detailed and justified Design Specification.

Successful Candidates:

- Choose a theme
- Create a 'mind map' to identify action points
- Clearly identify the needs of the user and explain the situation in which the prototype could be used.
- Conduct detailed research – considering the changes in existing products, identifying trends, identifying specific materials and identifying the technologies used
- Produce a comprehensive Design Brief and action plan for realising the brief
- Conduct further research using critical analysis of a product to evaluate function, user needs, consider specific material properties, sustainability, and product life cycle
- Make specific reference to an 'Eco-Web', considering the sustainability of a product in detail
- Make a summative evaluation of the research activity leading to conclusions which will help form a Design Specification and final list of User Needs

Designing
The presentation and justification of Design Specifications continues to improve. There was clear evidence that the candidates had considered how they would control the proposed system and there was clear evidence in many examples of the work presented for moderation.

Could I once again remind Centres that using bullet points (or numbers) is the easiest way of showing a Design Specification, long detailed descriptions of each point are time consuming and unnecessary.

A justification can be made using the terms, 'because' or 'so that'

The use of a Systems approach to starting the design process is clearly evident in many portfolios. This clearly shows a range of INPUT and OUTPUT devices.

Most candidates produce a range of ideas with detailed notes on the components used in each idea. A range of methods are used, including pencil drawings and the use of CAD programmes. In this section there should be clear evidence of how the design idea fits in with the need of the user. There should be clear reference to the Design Specification. Please note that in some Centres, candidates were given the same circuit as a starting point. This is not good in trying to develop individual ideas and limits creativity and access to the higher marks. Designed circuits should not be identical.

The Design development continues to be one of the weaker aspects of the Unit. Most candidates undertake modelling to test their best idea. This is often a repeat of one idea to see if the circuit or mechanism works. Candidates should use this process to combine ideas, make modifications and suggest alternatives. Once again there should be reference to the need of the user and the Design Specification. There should be comments about the changes made to the original idea.

Candidates are expected to 'design' their own solution to a problem. Simply copying the ideas from the internet gains little credit. The class teacher plays an important role in ensuring that candidates have the opportunity to be creative – candidates should not be guided into a set design because it suits the centre resources.

It was good to see that most Candidates produced a final design following the modelling stage. Candidates should list the components and materials to be used in the Making stage.

Successful Candidates:

- Produce a detailed, justified, measurable, Design Specification, for a prototype system **not** a product. Please note that detailed does not mean a paragraph on each individual point.
- Create a range of ideas with written explanations of how and why each idea could work.
- Make specific reference to the needs of the user and the Specification.
- Select ideas for development and test these ideas to develop a final design using modelling.
- Modify original ideas to produce a final design for a prototype system.
- Show full details of the final design including materials, components and a consideration of size.

Making

A detailed plan needs to be produced before the start of the making process. It was good to see that most candidates produced a plan. However, Candidates need to consider all stages of the manufacturing process including the soldering of individual components.

Generally, candidates produce high quality prototypes, either as a circuit or mechanism. Candidates are judged on the quality of the manufacturing.

Successful Candidates:

- Produce a plan that includes include specific reference to materials, processes, tools, equipment, health and safety and quality control. The plan should make reference to individual stages of production. 'Populating a PCB' is too generic.
- Show evidence that they have selected and used tools and equipment to construct, assemble and finish a working prototype.
- Manufacture a working prototype system
- Use tools and equipment in a safe manner, producing accurate stages of manufacture.
- Emphasise the use of a control system for the prototype

Solving Technical Problems
It was good to see that most candidates presented clear evidence of solving problems this year. This section should enable candidates to comment on the making process and show how they adapted to difficulties as they arose.

However, it is clear that some centres are producing generic SNAG sheets at this stage.

It is most unlikely that all candidates would solder an LED 'the wrong way round' or that all candidates would need to add 'jump wires'

A SNAG sheet should be presented, clearly indicating when and how the candidate solved problems during the manufacturing stage.

Please note that the comments can be positive and reflect the high quality of manufacture 'because'…..

Successful Candidates:

- Link this section to the production plan, clearly indicating how they solved problems as the prototype is manufactured
- Clearly show a SNAG page, highlighting the problems that occurred during manufacture of the prototype and giving clear evidence of how the problems were solved.

Record Key Stages
It was clear this year that most candidates record all the stages of manufacture and present evidence of their work. There were few occasions where Centres needed to be contacted to supply further evidence of attainment in photographic form.

It is essential that when marking the controlled assessment, teachers fully check the authenticity of the work at all stages. Library photographs should be fully referenced. It was clear in some cases, that candidates had taken photographs from a shared area and duplicated evidence in their power point presentations. In all cases it was clear that candidates had produced individual circuits but presented an incorrect image for moderation. This may lead to issues of malpractice for a Centre.

Some Centres awarded full marks when the evidence presented did not justify the award. Most centres produce photographic evidence of the manufacturing stages. It is important to describe the processes and techniques used. A photo diary on its own with no commentary will not justify full marks.

The comments should relate to the individual project. It is important that the photographs are of sufficient quality to reflect the quality of work completed. When producing a PCB, the photographs should show evidence of the quality of soldering and construction of the control system.
Last year's report emphasised the need for showing detailed evidence of manufacture.

The population of the PCB or assembly of a mechanism should be shown, stage by stage.

Successful Candidates:

- Fully record all stages of manufacture, using photographs and notes. This includes evidence of producing a PCB and/or using CAD/CAM
- Record all stages of PCB or mechanism manufacture, including photographs of PCB population, stage by stage.
- Show clear evidence of the Final Prototype in use, with photographs which clearly show the quality of manufacture including soldering and assembly.

Critical Evaluation
Most Centres now recognise that candidates should comment on the designing and making processes in this unit. It was good to see an overall improvement in the Critical Evaluation this year – with successful candidates commenting on their evidence of high quality prototypes, high quality soldering and clear indication that the prototypes fully function as intended.

Candidates do not need to evaluate the Design Specification in this unit. Despite previous guidance on this issue, some candidates wasted valuable time on this exercise, gaining no credit.

It is important that Centre's allocate appropriate time to this section of the unit and allow candidates to achieve the higher range of marks. Many Centre's produce unit A511 in year ten where there should be time to complete the Critical Evaluation in detail.

Simple testing is important to see if the system meets the original needs. Comments are then made for improvements in the system function; these are rarely completed in detail.

It would be useful if the Centre added teacher comments about the success of the system.

Most folios were well presented in a logical order and the majority of centres awarded the correct mark for Spelling, Punctuation and Grammar.

Successful Candidates:

- Produce a critical evaluation of the making process, for the prototype system.
- Fully test the prototype and suggest improvements
- Present their work in a logical, structured format.
- Use the correct technical terms, using words accurately.

A513 Making quality products

General Comments:

As we move towards the end of this Specification, it is good to see that most Centres are familiar with the requirements of this controlled assessment unit and there were few problems this year with regard to completion of the appropriate assessment forms. Very few Centres needed to be contacted to chase up missing work or missing documentation.

It would be useful for centres to place a copy of the IMS form in with the work selected for moderation.

Similar to A511, there were some issues with Controlled Assessment work becoming 'lost in transit; or lost at the Centre itself. It is essential that all work is clearly marked with Centre Number, Candidate Name, Candidate number and Unit number. This particularly applies to candidates who presented work in A4 card folders. In some cases the folders were worn through use, labels were ripped or damaged – this made identification of the individual work very difficult.

Most centres submitted the appropriate paper work on time, close to the 15th May deadline. Centres are reminded that upon receiving notification of the selected sample, candidates work should be posted to the appropriate moderator, within three days of receiving the notification.

In this unit, candidates need to design and manufacture, a fully working, product.

A513 continues to be a successful controlled assessment. Centres are to be congratulated on the work shown for this unit.

There were fewer entries submitted through the Repository this year. Most centres provided work, completed on A3 or A4 paper. Centres are reminded that folders need to be bound appropriately with a cover sheets attached. Despite my advice every year, Centre's are still using large, bulky folders which make life very difficult when dispatching work between moderators and the centre.

There is an increasing number of Centres presenting work on CD ROM's. This method is particularly beneficial in providing photographic evidence of manufacture. Showing fully functioning products, with short commentary on the success and failure of the products, is to be commended.

To avoid suspicion of malpractice Centre's need to ensure that if work is placed in a shared area – it is clearly labelled with the candidate name and number. Teachers and candidates must take responsibility to ensure there is no duplication of work (in error or deliberate) which could affect the marks of all candidates in a Centre.

Generally, the completed products seen during the moderation process continue to be manufactured to a high standard.

However, reports from moderators indicate:
The 'Plan of Production' still was often generic or missed the PCB manufacture out, some centres listed all the soldering as 'one step'. Stating that 'I will populate the PCB' is not detailed planning.

Technical solutions still require more evidence in portfolio's, as many centres awarded some/full marks without any justifiable evidence. Comments can be positive as well as negative.

Some candidates make vague comments about soldering a component the 'wrong way round' They can actually make positive comments about their PCB layout working successfully and allowing satisfactory population of the board.

Some candidates are still producing simple 'transistor' circuits.

Similar to last year it should be noted that some Centres are relying on library circuits, either school based or from internet software, leading to whole batches of very similar products. When this happens, it affects the creative aspect of the design process and candidates will not achieve the higher marks available. Too often, candidates simply use a bought circuit and/or case and the controlled assessment becomes an assembly exercise. Centres must ensure that candidates have the opportunity to 'Design and Make' in this unit.

Specific Comments on:

Designing
Using a mind map is the best way to start investigating the theme. Candidates are reminded that this section should be concise and 'padding out' this section will gain no more than four marks.

It was good to see that Candidates had taken note of last year's report and considered the analysis of an existing product as a starting point.

Most candidates produced a detailed design brief clearly identified the need and problem to be solved.

The majority of Controlled Assessments contained a detailed and fully justified Design Specification. This continues to be a strength of this unit.

It is good to see that centres are using a system approach at the start of ideas, but centres must ensure that candidates then produce a range of full circuit ideas. Selection of designs/ideas is still poorly completed, where most reasons seem to be based on the ease of making the circuit or system, rather than consideration of the user. Some Centres limit the choices of Candidates work by providing pre-determined circuits and components which all candidates use.

Modelling, either on breadboard or virtually via CAD software is used by the majority of candidates. However, the modelling is used to test whether or not the final idea works, rather than using modelling as a development tool to modify, change, and finalise the best design.

Candidates should be using modelling to develop and improve the initial ideas. Annotation should reflect the changes and modifications to be made.

The casing of a structure needs to be developed in the same way as the control system. There was evidence of quality sketching and creative ideas. However, these ideas were often dismissed because it's easier to put the components in a rectangular box!

There was limited evidence of candidates working out how the control devices would be placed on the case/container.

Candidates who achieved highly, created innovative case/structures, together with creative circuits/mechanisms. There were some outstanding examples this year.

The use of CAD, continues to develop and candidates are to be congratulated on the presentation of case/structure/mechanism designs. It is good to see the direct connection to manufacture where centres use laser cutters or a CNC router/miller. Some centres are making use of 3D Printing. This is useful particularly for mechanisms – with moving parts or components.

Where centres use bought in cases, it is important that candidates show in detail how the box is being used. Fixing of the PCB, battery and cable routing must feature in the design work.

It is important that the case and circuit fit together to form a completed product.

Too few centres fit the PCB and battery securely in the case. Switches were regularly incorrectly fitted, with slide switches mounted on the wrong side of the panel, or the thread showing on toggle switches etc. which wasn't reflected in the marks.

When there is a lack of evidence with regards to the use of components, relevant to the size of the case, the final product is incomplete and will not be awarded full marks. The final design should be shown, as the PCB mask or the mechanism layout together with fully dimensioned details of the container or structure

Successful candidates:

- Start from a THEME and identify a problem. This may include ergonomic data, illustrating the need and making reference to any important component/part.
- Produce a summary which brings out the main points which must be considered.
-
- Clearly state the function and performance of the product in the design brief.Produces a list of Specification Points which are measurable and related to the user/client, enabling them to be used in the evaluation.
- Appraise and develop creative ideas clearly linked to the specification and need.
- select reasons based on user need. When modelling, the selected system is built and then improvements made to make it match the need of the user.
- Finalise the control system and the structure with clear details for making the product.

Making

Most candidates produced plans, including detail of materials, equipment, health and safety, quality control and time.

Candidates should consider the soldering process as a series of stages leading to full population of the PCB – not one stage!

Candidates showed good quality making, both in the control system and case/structure. It was good to see high quality products using mechanisms, this year. Few candidates use pneumatics in their products.

When there is no evidence of the designing or modification of a circuit, candidates cannot be awarded full marks. Assembling a pre made kit, with perfectly drilled holes does not test the candidate(s) ability to manufacture a quality product. It is simply an assembly exercise. If candidates use pre-bought cases then these should be clearly adapted to solve the need. This could include marking out, drilling, adaptation of mounting devices and links to the control system.

Centres are reminded that candidates are awarded marks for producing PCB's. Candidates are judged on the quality of soldering including the number of scorch marks and use of wires to complete the circuit. Candidates can gain marks in the next section by suggesting how they solved problems during the manufacture, however, poorly designed and manufactured circuits, which clearly don't work, will not gain access to the higher marks available.

Solving Technical Problems

It is expected modifications and changes will be made during the making stages and these should be recorded in writing with reasons for the change. This section can include more than just things that go wrong.

Many successful Candidates produced a fully detailed SNAG sheet this year.

Some teachers state that full marks were awarded because the candidates 'solved problems – throughout' There needs to be written or photographic evidence.

Some candidates struggled to show how they solved technical problems because they used pre-made kits for a particular circuit.

Please note that where candidates produce identical SNAG sheets all listing the same technical problems – they will not achieve full marks.

Record Key Stages This section continues to improve and most candidates produced detailed evidence of how they made the product. Candidate labels should be more evident to ensure the images are unique. It is good to use library images for the start of the project when manufacturing a PCB, but care should be taken to show the real work of candidates when assembling the control system.

Where centres link the recording with the production planning chart, care must be taken to ensure that planning and evaluation are completed separately, before and after making.

Successful candidates:

- Include a production planning chart which breaks down the stages of manufacturing the control system and the case or structure, then shows the assembly stages through to final testing. The chart records materials, equipment, quality control points and expected time.
- Use a range of construction methods, using their own skill for a high quality product.
- Make and record changes and modifications to ensure the product match the needs of the user/client. The candidate records all the changes of both manufacture and any reworking that is necessary.
- Demonstrate solving technical problems with a written log.
- Record the key stages of manufacture, with a set of detailed pictures with comments of the stages, showing the testing with the product working, in an appropriate situation, linked to the user.

Critical Evaluation

Most candidates use the design specification when looking at the final product. This comparison works well when the specification is written as measurable points for the performance of the product.

Using members of the user group for testing the product can give good feedback when the group makes constructive comments.
Effective testing should be recorded to show the performance, and this is where the short video clips, mentioned above, are useful. When matching the product's outcome to the user need, real points of modification and improvement arise.

There were excellent examples of testing this year with clear evidence provided, by a video of the final product –Centre's are to be commended for this approach

Successful candidates:

- Write critical points when comparing the specification to the final product.
- Test the final product and show clearly how the product works for the user group and brings out points where the prototype needs modifications and changes.
- Use sketches and notes show how the second prototype will be different and improved.
- Organise the folders and use specialist terms appropriately and correctly.

A515-01 Sustainability and technical aspects of designing and making – Electronics Paper

General Comments:

It was pleasing to see that there were only a small number of 'no response' answers which were not linked to specific questions. Similarly, there were very few candidates who failed to complete the paper fully. The number of candidates failing to complete the paper and the number of 'no response' answers continues to reduce year on year.

It is important to stress that questions must be read fully before an attempt is made to respond. This is particularly important with the '*' questions which test the quality of written communication. If the question is misinterpreted a lot of marks can be lost. Again, this year there were very few instances of 'bullet point' lists or repeated points within these questions this year which was pleasing. There were still a number of candidates who repeated the question stem at length as part of their answer. This was especially seenon the '6 mark' written responses although this has decreased from last year. Candidates may have been told to try and fill the space, but it should be understood that there are never any marks awarded for repeating the initial question as part of an answer on any of the questions on the paper.

Where a question requires candidates to sketch as part of their response, candidates who were most successful made full use of the space available so that sketches were clear. It is important that candidates use clear annotation and provide sufficient detail in their sketch and annotation to allow the examiner to give credit for the understanding shown.

It is also important that candidates take care to ensure their answers are legible to the Examiner, and that they do not put themselves at a disadvantage if credit is not able to be given because the response could not be read.

If candidates use the additional space at the back of the paper or in a space not intended for a response to all or part of a question it is vital that the response is clearly labelled with the question and part number. It is also a good idea to put a note in the correct response space for the question part indicating to the examiner where the additional work has been carried out.

Candidates demonstrated through their answers in Section A, a good general knowledge and understanding of sustainability issues.

Knowledge of commercial practice is an area of weakness demonstrated by many candidates through their answers. This knowledge can best be gained from the disassembly of electronic products. Candidates who had carried out this type of work were clearly better equipped to answer the questions which covered design features and understanding of manufacturing techniques and casing construction.

Knowledge of certain components and their use in circuits continues to be an area of weakness. Candidates need to understand fully the use of all components as outlined in the relevant section on the course Specification

Comments on Individual Questions:

Section A

Questions 1-15 consisted of 1 mark responses and they were, generally, well answered with very few nil responses.

Question No.

Q1 The majority of candidates answered this question correctly, identifying that screw on tops from plastic containers contain different chemical properties.

Q2 This question was well answered with most candidates identifying that tertiary recycling could be described as using a chemical process to break down an existing product.

Q3 This question was well answered with the majority of candidates correctly identifying that disassembly of products does not add to the use of landfill sites.

Q4 Very few candidates failed to correctly identify that the symbol in question 5 was the recycling code for a specific material in this case aluminium.

Q5 Ergonomics continues to be an area of the specification where candidates are less clear on meaning and this was reflected in the percentage of candidates correctly answering this question.

Q6 Candidates showed a clear understanding of why products should be adapted and reused with typical answers referring to a reduction of waste and products being placed in landfill sites therefore less harm to the environment being caused.

Q7 There was little understanding demonstrated about 'carbon offsetting' and what this entails. Answers given generally related to the amount of 'carbon footprint' rather than the 'paying back' toward emissions created or setting up projects that are environmentally beneficial.

Q8 Candidates answered this question well demonstrating a good understanding of why CFL bulbs are more environmentally friendly than incandescent light bulbs. Typical answers referred to their use of less energy or that they last longer.

Q9 There was a clear understanding of the use of the colour red as a warning, with candidates typically suggesting that red was a colour that drew attention, stood out or was easy to see.

Q10 It is important that candidates are clear about the definitions of the different 'Rs', some candidates correctly identified that not having a material because it is harmful to the environment or people is to 'Refuse' although a number of answers relating to the other five Rs were given.

Q11 The majority of candidates answered this question correctly.

Q12 A number of candidates were unclear about the meaning of moral issues resulting in this question not always being answered correctly.

Q13 This question was correctly answered by the majority of candidates.

Q14 The majority of candidates identified that solar power is not a finite source of energy.

Q15 Candidates clearly understood that globalisation has not decreased international trade with the opposite being true.

Q16(a) This question was well answered with the majority of candidates gaining 3 marks and only a small minority failing to gain any marks. Common answers identified the handle, the ability to lock and release the lead using the button, and the clip to attach the lead to the dog's collar as design features. Where candidates failed to gain credit

their answers were too general or gave a feature that had already been identified in the question stem.

Q16(b) The majority of candidates gained at least 1 mark for this question with common answers identifying the that not having a power source meant less harm to the environment linking this to the manufacture and disposal of the power source.

Q16(c) Understanding of smart materials is an area of weakness in candidates' knowledge with many candidates not knowing what a smart material is.

Q16(d) Most candidates achieved at least 3 marks on this question. Those candidates who were most successful and obtained 3 or 4 marks made full use of the space available so that sketches were clear. Importantly, these candidates used clear annotation and provided sufficient detail in their sketches and annotation to allow full credit to be awarded for the understanding shown. To gain full marks candidates need to ensure that they name specific materials and not just generic ones such as 'plastic'.

Q16(e) There was a good understanding of the properties of corrugated card demonstrated through candidates answers with common answers including its ability to be recycled, its strength and ability to protect its contents, and how easy it is to manufacture and work with.

Q16(f) Candidates showed a clear understanding of globalisation and its advantages and disadvantages. Common answers referred to the availability of a greater range of products in different countries whilst identifying the potentially harmful environmental impact of this, caused by the transportation of these products across the world by air, land or sea. Candidates were also able to make the connection between the availability of new/better products and increased living standards. Many candidates made the argument that increased globalisation meant that there were employment opportunities for people living in developing countries whilst also acknowledging the negatives this can bring of poor work conditions and low pay if not properly regulated. There was a clear improvement this year in the written quality of candidates answers which was pleasing, answers were generally well written with correct use of spelling, punctuation and grammar.

Section B

Question No.

Q17(a)(i) Although some candidates correctly identified the drill bit as being 8mm for the hole in the panel, the majority answered this incorrectly and were unable to interpret the drawing.

Q17(a)(ii) To gain marks on this question candidates need to correctly identify tools to mark out the panel. It is also important that candidates read the question carefully as many lost marks describing how they would drill the panel which was not what the question was asking. Candidates gaining marks generally suggested the use of a pen to mark the centre of the hole, some then went on to identify the use of a centre punch to mark the hole ready for drilling.

Q17(a)(iii) Answers to this question incorrectly referred to the use of generic PPE or ensuring the drill bit was sharp and lined up with the centre of the hole, and not to a manufacturing precaution related to drilling an aluminium panel. Common correct answers generally referred to clamping the material down or feeding the drill slowly. Fewer candidates were able to gain the second mark available by explaining why the precaution they had identified was necessary/what effect it would have.

Q17(a)(iv) The majority of candidates gained at least 1 mark for this question although there was a lack of understanding of the correct placement of the split washer. There were a number of candidates who failed to attempt this question.

Q17(b)(i) Many candidates lacked knowledge of the use and benefits of ribbon cable given their answers. Common correct answers referred to improved cable management with all the wires neatly joined in a single cable, as well as the flexibility of the stranded wire used in ribbon cable.

Q17(b)(ii) Most candidates are familiar with the attachment of flying leads and the use of heat shrink sleeving to prevent a short circuit. However, whilst candidates often sketched this they then omitted to use sufficient notes to explain their sketch and how the cable was soldered in place before the heat shrink was applied. Some candidates seemed to feel that you could apply heat shrink without soldering the wires in place first and in doing so limited their marks.

Q17(c) A small number of candidates scored well on this question. Some candidates were able to identify a method of ensuring the holes are in line however most failed to consider how they would then ensure that 20 panels were identical. Identifying what the question is asking and then the use of more than one sketch and detailed notes are key to being able to successfully answer this question.

Q18(a)(i) Many candidates were unable to correctly identify the correct binary outputs for the number 3, with a range of answers being given incorrectly.

Q18(a)(ii) Candidates struggled with correctly identifying the correct placement of the AND gate, those attempting this generally placed the gate correctly.

Q18(b)(i) Few candidates achieved full marks on this question. Many were unable to identify the total resistance with SW1 open failing to add the resistant of R2 and the lamp, and so were unable to gain any marks. Candidates need to be familiar with the use of calculations such as Ohms Law and substituting given information into the formula including rearranging this formula where required.

Q18(b)(ii) A minority of candidates were able to identify that the lamp would be brighter with SW1 in the closed position.

Q18(b)(iii) The majority of candidates scored at least 1 mark on this question, generally this was for connecting R2 to the lamp. Many candidates confused the base and the collector connections on TR1 making their connections incorrect. Candidates need to be familiar with identifying the correct legs on physical components and how these relate to a PCB layout. Some candidates are still crossing tracks on a PCB layout, although an increasing number of candidates indicated the use of 0 Ohm resistors or bridging wires to cross tracks and included the location of additional pads for this to happen which was pleasing.

Q18(c) Candidates answers to this question were generally good with the majority of candidates achieving a Level 2 or 3 response and marks within these bands accordingly. Candidates were able to discuss the benefits and drawbacks of using solar panels for powering electronic products giving a balanced argument. Common answers included the sustainability of solar panels and minimal pollution generated once the initial outlay for purchasing the panels had been covered. All candidates identified the drawback of no energy at night / reduced energy on cloudy days particularly given the UK climate. Higher scoring candidates typically identified the limited power available from solar panels and problems this may cause as well as showing an awareness of the harmful chemicals used in the manufacture of the

panels and the negative impact of this. It is important that candidates read the question carefully and do not stray off of the question asked, by answering a more generic one in this case the benefits and drawbacks of solar energy as a small number of candidates did.

Q19(a) Most candidates secured a minimum of 1 mark on this question. There was less understanding shown of warning labels that could be found on an electronic product, correct answers generally referred to the product not being suitable for small children or the potential for a laser/radiation hazard. Many candidates included general flammability symbols however to be awarded a mark these need to be specific to electronic product hazards. Candidates were more familiar with information labels to be found on electronic products and common answers referred to control markings such as on/off switches, or disposal/recycling information such as not throwing into a waste bin.

Q19(b)(i) Candidates showed good understanding of the function of the amplifier module to make the speaker louder or to allow the sound to be heard.

Q19(b)(ii) Many candidates identified 'C' as being the most suitable amplifier for outdoor use.

Q19(b)(iii) Candidates who correctly answered 'C' in the previous part of the question tended to identify the reason correctly for their choice as being that 'C' gave the highest power (50W). Where candidates answered incorrectly this was often linked to a wrong answer for Q19(b)(ii) and a misunderstanding of the circuit being mono therefore a stereo speaker would not be of benefit, or misunderstanding the different units of power i.e. thinking that 100mW was larger than 50W.

Q19(b)(iv) This question was well answered with candidates understanding why it was necessary to protect steel in an outdoor environment.

Q19(b)(v) This question was well answered with answers referring to adding a layer of paint or covering the steel in plastic or to galvanising the steel to protect it.

Q19(c)(i) Most candidates achieved at least one mark on this question. Common plastics identified were Acrylic or HIPS, and common properties referred to the materials strength/durability and its suitability for use outdoors/resistance to water. It is important that candidates are able to name specific materials and not just generalisations such as plastic.

Q19(c)(ii) This question was not well answered with responses showing a lack of understanding of the shape of a former for vacuum forming the speaker casing. Very few candidates were able to successfully draw a suitably shaped former or identify any important features of a former for example rounded edges. It is important that candidates understand processes such as vacuum forming through practical experience and that they can explain the features of successful formers for when they make their own as part of the controlled assessment unit.

Q19(d) This question was not well answered with responses showing a lack of understanding of smart materials or experience of specific smart materials. Successful candidates were able to identify the property of the material and give an example of the material in use. Where candidates were awarded marks they tended to be familiar with shape memory alloys and its use in glasses.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553