Examiner's Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE
In Design & Technology (5EP01)
Paper 01: Electronic Products

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Introduction

It is as ever, very humbling to see so much good electronics work going on in centres across the country. The level that these candidates are working at to understand electronics and apply them to different scenarios, coming up with a range of circuits and explaining them, then developing these is fantastic to see. The work the candidates have produced covers a range of tasks and projects under those headings, all of which were varied and set up to support the candidates in your schools. New technologies tended to become the norm in some places with even newer technologies like 3D printing being used to produce casing designs. A large proportion of centres have chosen to deliver a separate design and make activity and these centres are geared up to support their students through a similar product manufactured or a completely different task. Other centres who have stuck to the combined design and make activity have equally allowed them to achieve. All centres chose projects from the themes given.

Administration

This was the first year without the OPTEMs and so required you to log on to Edexcel Online to manually input the correct marks electronically which seemed to work well. Administration generally was good and centres sent the highest and lowest in the sample if they had not been preselected. Still, as mentioned last year, some centres are stapling CMRBs to student's folders which is difficult to remove. This is equally frustrating when candidates do not place their name, candidate number, centre number on every sheet. Candidates should fasten all pages together. There is no need to send work in folders, A3 document wallets or Flip files, two staples will suffice. In some cases, whole centres placed the work in an order that was not the same as the order in the CMRB. This saves work for assessment being missed, especially if it is not referenced in the CMRB. Further annotation in the form of page numbers and comments are useful. Highlighting or rewriting the specification is not. This is particularly useful when work is out of section or you want to highlight what the candidate has produced.

A detailed breakdown of the different sections is given below.

Analysing the Brief

Over the years more and more candidates have achieved the higher marks in this section through teacher's reading feedback from the moderators. More candidates are thinking about careful questions that underpin the brief and project and can drive research. There were still some centres who used generic spider diagrams with words pulled from the specification and generalised statements or questions which score low marks. Candidates should be looking at focused questions that leads to focused research. The questions should drive the research and get under the skin of the project. Centres whose candidates tended to achieve full marks produced tables or a series of questions, usually under headings such as User, Circuit and Case, to achieve a broader set of questions.

Research

Research by candidates was on the whole selective and interpreted well by candidates. Many centres are still unclear on what a good quality research section should contain. A lot of centres tend to fill this section with every form of research including Batteries, Questionnaire, Product Analysis and Component Research. Although the section is marked out of 6, it is the analysis they are assessed for which should be in sufficient detail. Some centres had produced a wide range of research but the analysis was lacking in detail and in other cases the range of research was not enough to warrant the higher level marks. Candidates who exhibited several pages of research were often leniently marked by the centre as the centre felt it was detailed but actually it was general as there was so much of it. It is far better to see less research but more of the candidate's thoughts. Candidates who researched the questions set out in the Analysis of the Brief were able to achieve some detailed focused research. What is often missed is some research into the situation or the problem first hand; how large is the space? What does it need to do? How bright does it need to be? How far does it have to be heard/seen? These are usually questions in the Analysis that get lost in the ether as the candidates focus too strongly on the generic pages; Product Analysis, Component Research, Batteries and Questionnaire, however this is a good method to follow.

When candidates looked at Batteries, they tended to look at voltage, mAh dimensions, weight and chemical type, but the better students will look at advantages and disadvantages and draw comparisons between them, looking at chemical types lasting longer, or AAA being smaller and so weighing less. It is this deeper analysis that separates the high ability candidates.

When candidates produced Questionnaires many candidates tended to ask irrelevant questions with little analysis of the answers. Many candidates did not gain any useful information which would help write a purposeful specification or aid the designing stage.

Where centres had trained candidates to write a good Product Analysis, the quality of analysis was detailed and useful. Good centres tended to get candidates to analyse products for input, process, output functions, power source, size, function, materials and manufacture, user requirements. Excellent centres were able to include sustainability and quality.

Component Research tended to be completed poorly by many centres becoming a copy and paste exercise. Many centres tended to produce a picture of a series of simple components, a name, and a brief description of what the component does. The weaker candidates produced several pages of component research which included research on power sources (batteries mainly). A few centres were able to do this well because they were selective and the components researched were relevant to the project. The research on components included size, power rating, a pin out diagram, a detailed understanding of how/where the component could be used to achieve a desired outcome with advantages and disadvantages.

The better candidates summarised the research either page by page or at the end of the research but before the specification was written.

Specification

Specifications had been written well and teachers were assessing accurately across this year's series and the standard of Specifications produced this year was much higher. Centres should guide their students to ensure that points are justified with a specific reason. Just because the point is justified is not enough to warrant meeting that criteria. It is so useful for candidates to produce measurable points such as 'it must turn on at 20 degrees', 'it must turn on at 20 lux' or 'it must be seen from 10 meters away' are tests that can be carried out by candidates in Testing. The very essence of electronics makes points technical if they mention turning on for a period of time, using an override facility or producing a display using a 7 segment display.

Initial Ideas

A range of approaches were taken with Ideas, however the majority of centres had led their candidates to produce a range of circuits. Some centres are still producing very similar circuits, for example, two transistor circuits and four 555 circuits. Candidates should be producing a range of circuits using a range of process components and even a series of process blocks joined together to make more complex circuits. It has now become the norm for centres to follow the broad two thirds, one third rule for circuits to cases. Some centres are producing say four pages with each Idea being made up of a case and a circuit which is equally fine. Some centres are still however evidencing complex circuits and not describing what the components do and how the different arrangements make up the overall circuit. Candidates do not need to design these circuits but they do need to apply their knowledge to the circuits to explain their functionality. Most centres scored well for the electronics element of the ideas section but tended not to score as well for the case section as they were very simplistic or similar and the knowledge of materials and fitness for purpose or manufacturing processes and reasons for choice was not communicated well in their annotation.

Some centres are still mixing up Initial Ideas with Development. These centres follow a pattern which some other exam boards like to see and maybe in the future through iterative design, however it is very helpful to show which the initial ideas are, which one has been chosen and where the development is. A few centres do not have the right balance between circuit design and casing designs, placing a higher emphasis on casing designs.
A number of centres are producing circuit ideas which are too simple and have no or only one active component. It has been best practice to show the use of two process blocks in each design idea where possible. The better centres produce 3-4 circuits which range in complexity but are middle to high level of complexity. The candidates are able to explain clearly and with detail how the circuit functions, they also make use of features within the circuit designing software to show how the circuit functions.

Review

Candidates had either reviewed the ideas reasonably well or not well, there was no middle ground, however the work was of a much higher standard as the majority of centres opted to complete this work on its own page(s). This Each idea, circuit and case was evaluated against the specification and a summary produced at the end. Where centres had signposted Reviews and compared and contrasted ideas against one another and against the specification had achieved higher marks. Where Candidates had used tick boxes and numbers did not achieve the higher marks. Candidates should be looking at making objective evaluative comments that explain reasons for choice with improvements to take forward. Some centres over assessed the Review for annotations within the Initial Ideas, meaning that the designing is effectively being double awarded by the centre. Many centres were only able to achieve middle band marks because there was no or limited reference to 3rd party feedback.

Communication

This section largely was completed to a high standard. Most candidates were able to demonstrate the use of a range of communication techniques within the design section. So many centres state 'Throughout' or 'All' and it is to be remembered that Communication is assessed from Initial Ideas through to the Final Design. It is within these pages that candidates will be able to show their ability to draw circuits, PCB masks, card models, 3D CAD models, sketches by hand and written communication with precision and accuracy. This section was generally assessed accurately by the centres. Where candidates had drawn casing ideas, these did not tend to be drawn with precision and accuracy and did not sit in line with the neat CAD models or circuit schematics. The number of centres opting to make use of 3D modelling and CAD modelling was high and this really helped raise the standard of work for many candidates.

Development

This section is always approached from a wide range of standpoints. Most centres marks were agreed for this section however candidates should be reminded that for marks at the upper end of the scale, they should be making significant changes to the circuit. Changing values of a resistor is not a significant change. However it is the PCB development where candidates' developments evolve and it is nice to see candidates making and documenting changes as they move to produce compact circuit boards.

Centres demonstrated the development of the PCB and the different outcomes through tessellation, along with commentary to explain the rationale for movements. Although it is not mandatory, it was particularly impressive to see centres still bread boarding developments in their circuit ideas. For both the PCB on screen and bread boarding tasks, candidates should be explaining and showing how it tests important aspects. Many candidates did not fully evidence the PCB population. This made it hard for

the moderators to agree with the centres marks where a PCB appears. Centre should be advised that the record of development should include screen shots and written notes, explaining what is happening at each stage, any problems and what the candidate does to solve the problems.

The same can be said for the casing development. Centres tended to favour CAD modelling over hand drawn sketches as they were able to make several iterations easily, however they should be showing that it fulfils an important test, rather than making it for aesthetic qualities. More centres were seen to be producing card models and again, had produced it for the sake of the task, rather than showing it after the PCB had been produced with it in place, or using the PCB mask to show it fit inside. As in the Initial Ideas section, students do not explain the casing development as well as they do in the electronic element of the development. Some centre heavily guided the candidates and the final developed casing was unrecognisable when compared to the initial idea and in these instances the case ended up being a rectangular box. The better centres made use of card/foam modelling, incorporating user group feedback and CAD modelling. The modelling process tended to see more creative development casing ideas. It was however rare for centres to use user group feedback in this sub-section. Best practice sees candidates make reference to user group feedback on the circuit development, PCB development and casing development pages as a prelude to a conclusion.

Final Design

Most centres presented a PCB design proposal and a casing design and was completed to a higher standard this year. Materials and components were stated, but seldom explained. Most of these centres had a systematic approach to list all components and materials with a PCB mask and a working drawing with realistic dimensions. There were some instances where the Development section merged in with the Final Design section and moderators tried to give marks for work that was placed in the Development section. Some of these centres had credited the work in both Development and Final Design and so, as a result, they had marked one or both sections leniently.

In this section we are looking for:

- component side of the PCB
- track side of the PCB
- a PCB mask
- a component list (with prices)
- an explanation of how the circuit would be manufactured

The final idea for the casing tended to be very basic and simple. It was typical to find a 2D design screen shot of the laser cutting parts. The best centres evidenced all or some of the following:

- 3D drawing/sketch of the case
- laser Cut Files or 3D printer information
- an engineering drawing or parts drawing with sizes and materials
- drawing and or explanation of how the PCB and off board components will be held in place

- cutting list for all parts including sizes

Production Planning

The vast majority of centres are producing a Plan of Production which considers the main stages of manufacture but are leniently assessing it as a high level production plan. This section was the weakest from all the sections. A lot of centres tended to duplicate planning. These centres produced mainly planning in two of three formats; a Gantt chart, a planning table or a flow diagram. Where candidates produced a Gantt chart, it lacked the detail on quality control but the main stages with some detail were listed in the Gantt chart. A planning table tended to be a format chosen by many centres however generally this allowed the plan to be comprehensive but candidates lacked clarity and detailed mainly the manufacturing and population of the PCB. Centres should be reminded of the need to specify the order in which components will be soldered onto the PCB, rather than 'solder in components'. The Gantt chart is a format which has helped centres to include Quality Control but this format similar to the planning table lacks detail and clarity mainly related to the population of the PCB.

The other issue that arises in this section is that of quality control. In order to achieve a high level mark, candidates should mention specific forms of quality control like 'test the LED holes are 10mm apart with a ruler' or test the voltage of the microcontroller by placing a volt meter across the positive and ground legs'. These are specific tests that relate to that student's project.

It should also be remembered that candidates should not produce their planning retrospectively. Less students have produced diaries (a retrospective plan) which achieve few marks as it is an account of what they have done, rather than forward planning a sequence which is more difficult to carry out.

Quality of Manufacture

The wide range of projects seen over the series was encouraging and within the spirit of this qualification. This year's submission on the whole was seen to be assessed accurately and highly as more and more students are producing a wide range of challenging manufacturing techniques which have been incorporated into projects this year. In some instances, there was a lack of challenge and skills used other than soldering, etching and some very basic vacuum forming. Centres should take note that more increasingly, photographic evidence produced and documented by the candidates is useful in assessing their work as it gives the moderators a greater insight into manufacture and a better understanding of the product as a whole. Assessor Witness Statements were detailed and completed with honesty and continue to be extremely useful in assessing candidates work.

Quality of Outcome

Centres tended to assess accurately in this section. Successful candidates anchored the PCB to the case with twisted wires and cable wraps or cable ties, produced and strain relief holes, used heat shrink on component legs and sought methods to support off board components and batteries. Casings were generally well made and assembled which was pleasing to see. Centres leniently assessed some candidates by positively assessing the use of excess amounts of wire and not using strain relief holes for off-board components.

In two or three instances, centres did not provide any quality of photographs of the practical. It is important that centres provide the moderator with a solder side visual of the PCB (and even a component side) and photos of the case from different angles with an internal view of the PCB and circuitry held in place. The moderator had to contact these centres to send photographic evidence as one external shot of the case is not sufficient to aid the moderator to make a judgement of the outcome based on one photo. A good time to take photos of the PCB is after they have been soldered and before they have been attached to the case.

The CMRB and Assessor Witness Statements is an area which centres need to provide more detail, especially if centres do not produce a manufacturing diary. Where centres produce a manufacturing diary, it was a real pleasure to see the stages of manufacture and this clearly showed the hard work of the candidates. Candidates were also able to explain what they were doing at each stage along with any difficulties they had overcome.

Testing and Evaluating

Evaluations were in line with expectations and generally contained testing against criteria, testing functionality and feedback from a third party. This is still an area of concern within the coursework folder amongst a many centres, as many centres do not understand the requirements. Some centres clearly have attempted or completed testing but not back it up with photographic evidence e.g. distance testing of a light source. It is so rewarding for the candidates to photograph the project they have been working on, and to physically test its functionality and more often we see not photos to evidence it working. What was refreshing was to see, in one instance, a centre had inserted short video clips into the PowerPoint.

Testing in a tabular format helped candidates to achieve to a good standard. Real world tests were prevalent for this series. User group feedback here was generally completed well as compared to previous series as it was more relevant. Some had reference to third party testing but there was often a lack of objectivity, sustainability and measurability. Better candidates had sourced an expert or someone who had a point of reference rather than a class friend whose comments were subjective and sometimes meaningless. Centres had tended to mark this section accurately. Best practice sees candidates use the measurable specification point, what the test would entail, what happened in the test, with a photo to evidence it happened. Most centres looked at 3 or 4 tests which was

sufficient to attain the high band marks. Some third party evaluations were clearly not completed by a third party and were completed by the student. Some centres were able to include third party interacting with the product and the comments here were more realistic and original.

It should be remembered that, where specifications are measurable and technical, this aids candidates in the testing of these points and allows them to test something quantitative.
Many centres tended to evaluate the idea against the specification and it was the norm to say the point had been met or not met. Candidates need to provide evaluative comments met and not met is simply not enough. Good centres colour coded the specification in red, amber or green to show if it met the point or not, but the detailed explanation helped to explain how it met or partly met or did not meet the specification point.

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