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AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

Report on the Examination

Design and Technology:
Electronic Products

- Full Course
- Short Course

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General

The paper was very accessible to the vast majority of candidates. There were less instances of scripts with questions or parts of questions being unanswered than last year. Question 3 the design-based question, was well answered. Candidates appeared to have read the question carefully, and for part (b), many candidates 'ticked-off' the specific requirements of the case design, thus ensuring they had access to all the marks. The quality of the drawings and the sketches were generally quite good. As in past years, simple marks were lost by naming generic materials, rather than more specific materials. Construction methods did not always match up with the suggested material and some sketches failed to clarify the confusion.

Candidates answered Question 7 well and clearly had a thorough appreciation of recycling and environmental issues, and demonstrated a good knowledge in the field of mobile phones. Candidates were able to express their thoughts and opinions although there was sometimes a lack of sufficient focus on the difference between the specific areas of consumers, society and the environment.

Question 1

Overall this question was well attempted with many candidates gaining good marks.

(a) The majority of candidates gained some marks. Thyristor instead of transistor was a common error.

(b) The concept of output was widely understood but both the input and process sections were poorly answered.

(c) Reasonably well answered.

(d) Candidates usually made some reference to sensing light, but relatively few referred to any aspect of controlling the transistor.

(e) Poorly answered.

(f) (i) Most candidates answered with 'throw' but few included 'single'.

(ii) Very poorly answered.

Question 2

(a) Well answered by many candidates.

(b) The feature and orientation of the LED were usually given but the detail of the IC was poorly answered.

(c) Answered quite well.

(d) The formula was usually identified but candidates had problems with the units associated with R1 and C1 and the placing of any decimal point.

(e) 'Voltmeter' was the usual incorrect response. The use of a multimeter as a dual function instrument was not well known.

(f) (i) Poor response, with some candidates mixing units.

(ii) A few correct answers were given but generally poorly answered.

Question 3

(a) Two ideas were usually drawn, but many showed very little difference between the two. Sketching was of a better standard than in previous years. Many responses lacked sufficient compatibility between the material stated and the method of construction.

(b) Most candidates organised themselves by ticking off the requirements and at least making sure that all were included in their responses. Although it was usually clear how the circuit and battery were to be made accessible, it was not always clear how the base or compartment was held in place or removed. Too many responses used generic terms for the materials to be used and construction methods did not always match the materials stated. Annotation needs to be succinct rather than lengthy. Sketches require details, so that methods suggested by the candidate are clearly communicated.

Question 4

(a) Well answered by many candidates. Most of those who did not use the suggested programming language did manage a correct sequence for the lamps.

(b) (i) Few candidates showed awareness of the low current output, and the use of terms power, volts and current was confused.

(ii) Very few candidates linked the transistors with current amplification.

Question 5

(a) Well answered by the majority of candidates.

(b) Fairly well answered.

(c) (i) This was well attempted.

(ii) It is regretted that there was an error on the third bullet point on the question paper. This referred to the connections to the "2nd and 3rd LEDs", which should have read "3rd and 4th LEDs". This obviously led to some confusion for candidates as the 2nd LED was already connected. Many candidates correctly connected the 3rd and 4th

LEDs and were awarded full marks. The mark scheme was also adapted in order that candidates who only connected the 3rd LED were not disadvantaged.

Unconnected with the error on the third bullet point, when a switch was drawn, many candidates had difficulty connecting to the correct points. A significant number of candidates just joined pin 15 and +V together.

There was a very mixed response to connecting the +V and 0V connections.

(iii) Very little knowledge of switch bounce was demonstrated.

Question 6

(a) (i) PCB and CAD generally well known.

(b) (i) Well answered.

(ii) Well answered by most although some candidates did struggle to articulate their reasons.

(c) Good knowledge of the PCB making process but often responses lacked qualification and detail.

Question 7

(a) Well answered but there was some confusion with the symbol meaning that the material had already been recycled.

(b) (i) Well answered

(ii) Generally vague answers related to rust and sharp edges.

(c) Well answered.

(d) (i) Well answered, although there was some misinterpretation of the question with candidates referring to the case of the phone.

(ii) Generally well answered although some candidates did not include enough detail or qualification.

(e) Well answered with some interesting and original ideas. Although some of the responses were not explained, or failed to make clear whether they would have a positive or negative effect.

Tier H

General

The paper was well accessed by the vast majority of candidates. There were very few instances of scripts with questions or parts of questions being unanswered.

Question 2, the design-based question, was well answered. Candidates appeared to have read the question carefully, and for part (b), many candidates 'ticked-off' the specific requirements of the case design, thus ensuring they had access to all the marks. The quality of the drawings and the sketches was quite good, and the notes were detailed, yet some candidates appeared to have rushed the question. As in past years, some marks were lost by naming generic materials, rather than more specific materials. For example, plastic rather than acrylic and wood, rather than pine.

Candidates answered Question 7 well and clearly had a very good appreciation of recycling and environmental issues, and demonstrated a high level of expertise in the field of mobile phones. Candidates were able to clearly express their thoughts and opinions although there was sometimes a lack of sufficient focus on the difference between the specific areas of consumers, society and the environment.

Some common areas that require improvement are:

- lack of qualification in the response related to what the question was specifically asking
- understanding the meaning and values of prefixes such as K related to resistors and μ when related to capacitors
- the lack of detail in sketching and the over use of written description when simple annotation of design details would suffice.

Question 1

(a) Answered well by the majority of candidates.

(b) (i) Most identified the IC, Capacitor and LED as being the components that needed to be placed in the circuit the correct way round.

(ii) Candidates answered confidently about the various features to look for but were sometimes unclear about polarity.

(c) Well answered although many candidates did not specifically identify R1.

(d) Well answered, although a common incorrect response was that it was a reset switch.

(e) Most candidates were able to identify the correct formula. However, many had problems with the placing of decimal points when using the 100μF capacitor and K units of the resistor.

(f) Most candidates understood what tolerance was but were unaware of the large tolerance and the effect that this large tolerance could cause.

(g) (i) Well answered by most candidates.

(ii) Well answered.

Question 2

(a) An improved set of responses compared with previous year, with some good sketching and annotation observed. The quality of sketching remains varied and the link between the suggested materials and appropriate construction methods somewhat tenuous.

(b) Far too many candidates produced paragraphs of written explanation as opposed to quality annotation or labelling. There were many instances of materials not matching the type of construction suggested and sketches not matching the suggested construction. Vacuum formed cases, with deep straight sides was a common mistake.

Some candidates failed to take into consideration the size of the circuit and battery or only provided one dimension. Very few candidates clearly showed sufficient detail of how the circuit and battery were to be made accessible. A common error was to 'screw' the base onto thin air, rather than showing an attachment point on which the screws might fix to.

The switches and LED were often placed on or near corners which did not allow for component fixing taking into account the thickness of the wall sides or, because of the vacuum forming process any necessary rounded corners.

The quality of drawing was generally good.

Question 3

(a) It was clear that some candidates had not experienced using PICs and the associated programming. Candidates at some centres were particularly successful at using a suitable programming language and providing the correct sequence to turn the lamps on correctly. It was noted that some candidates were unable to link a time command to the time delays.

(b) (i) Most candidates realised that the output from the PIC did not match the current requirements of the lamps.

(ii) Most candidates understood that the darlington pair would amplify the output current but many failed to clearly identify a suitable current.

Question 4

(a) Well answered by many of the higher achieving candidates. Common errors were in not counting correctly and forgetting that the start is at 0.

The quality of the circuit diagram was variable. Candidates would find it helpful if they used a pencil to draft the connections to enable checking to take place.

(b) (i) Switch bounce was not commonly identified for the response to this question

(ii) Those that answered (i) correctly usually mentioned a schmitt trigger or other ways of producing a digital signal.

Question 5

(a) (i) & (ii) Generally well answered.

(b) Most candidates understood that it was a comparator circuit or that it compared the values of the two inputs. Fewer candidates were able to respond with an explanation of the amplification of the difference of the two inputs or the sinking or sourcing of the output pin.

(c) Well answered.

(d) Generally very poorly answered with few detailing the back e.m.f and the damage that it could do to the transistor.

(e) (i) Some guessing but generally correctly named.

(ii) Some candidates clearly understood the working of the op-amp and were able to respond in detail. These responses were much improved on answers to questions with similar requirements that had been set in the past.

(f) Well answered by most.

Question 6

(a) (i) & (ii) Answered well by most candidates.

(b) Most candidates were aware of the stages of production and the necessary health, safety and quality issues. Marks were sometimes missed here due to a lack of clarity or detail.

Question 7

(a) The recyclable symbol was commonly recognised, but candidates sometimes failed to explain sufficiently about any specific gains for the environment.

(b) (i) Well answered although some failed to qualify their response sufficiently enough to gain full marks.

(ii) Most candidates wrote about the problems of non-biodegradable parts of packaging and the 'throw away' culture that was threatening the environment. Lack of qualification was often the reason why some candidates failed to achieve full marks.

(c) (i) Most candidates were able to state an advantage and disadvantage and many were able to explain those responses. Some candidates over generalised or gave simplistic explanations.

(ii) Well answered by many candidates, but several responses were not specifically directed at the environment.

Short Course

Tier F

General

The paper proved accessible for the majority of candidates, and there were relatively few un-answered or un-attempted questions. The paper contained many questions that required a written response with candidates being asked to describe or give reasons and explanations. The standard of answer seemed better than in previous years with more qualified responses given, Question 6 proved to be a high scoring Question for many candidates.

Question 2, the design based question was generally well answered. Candidates seemed to have read the question carefully and ensured that they responded to the specific requirements of (b). The quality of the drawings and the sketches was fair, yet some candidates appeared to have rushed the question, and candidates should be advised to spend adequate time on this type of question.

Question 4(a), the completion of the PIC program was very well answered, with the majority of candidates gaining full marks.

Question 5(c) was another high scorer, candidates were quite knowledgeable about the process of PCB manufacture although some found difficulty in using the more technical terms.

Question 1

(a) (i) Well answered.

(ii) Most answered correctly but some responded with just resistor.

(iii) Well answered.

(iv) Generally well answered.

(b) A large number of candidates recognised that the LDR was an input device and that the bulb was the output device. There was some confusion regarding the other input and process components.

(c) Not very well answered.

(d) Although candidates struggled with terminology many demonstrated some knowledge of the function of the LDR.

(e) Poorly answered.

(f) (i) Only a few candidates gained full marks with most candidates gaining one mark for “throw”.

(ii) Generally poorly answered.

Question 2

(a) Well answered.

(b) Most candidates knew about ‘longer’ and ‘shorter’ legs or ‘dots’ and ‘dents’ but few candidates were sufficiently specific about the orientation to gain full marks.

(c) (i) Well answered but some candidates did not make a specific reference to R1.

(ii) Most candidates mentioned ‘switching the circuit on and off’ and did not understand the function of SW1.

(d) Most candidates were able to identify the correct formula but many had problems with the placing of decimal points when using the 100µF capacitor and K units of the resistor.

(e) Poorly answered, voltmeter being a common response.

(f) (i) & (ii) Poorly answered.

Question 3

(a) The majority of candidates produced two ideas but too many named generic materials and gave only vague construction details.

(b) This was a well-answered question with candidates ensuring that they had responded to the specific details of the question. The quality of the drawings was somewhat disappointing and some candidates wrote large paragraphs of notes when quality annotation or labelling would have been more effective.

Question 4

(a) Very well answered.

(b) (i) The most common response related to 'lack of power' and few candidates scored well here.

(ii) Poorly answered.

Question 5

(a) (i) Generally well answered.

(ii) Well answered.

(b) (i) Very well answered.

(ii) Some candidates were a little vague with their answers but many scored well.

(c) The majority of candidates scored well and were able to list tools and equipment and mention health and safety issues. Responses for the 'Quality Issues' were generally vague and unqualified.

Question 6

(a) Very well answered.

(b) (i) Well answered.

(ii) Not very well answered.

(c) Most candidates scored well but some made reference to the case of a mobile phone and not the packaging.

(d) (i) and (ii) Although many candidates failed to express themselves clearly they did demonstrate a good knowledge and understanding and consequently scored well.

(e) Well answered although some of the responses were not explained, or failed to make clear whether they would have a positive or negative effect.

Tier H

General

The paper was well accessed by the vast majority of candidates, and examiners reported that there were very few instances of candidates failing to respond to questions. The majority of candidates demonstrated a good level of knowledge and understanding of basic electronic theory, and candidates also showed that their knowledge and experience of product design, PCB manufacture and production techniques was good.

Question 2, the design-based question, was well answered. Candidates appeared to have read the question carefully, and for part (b), many candidates 'ticked-off' the specific requirements of the case design, thus ensuring they had access to all the marks. The quality of the drawings and the sketches was quite good, and the notes were detailed, yet some candidates appeared to have rushed the question. As in past years, marks were missed by naming generic materials, rather than more specific materials. For example, plastic or wood, rather than acrylic or pine.

Question 3(a), the PIC program, was very well answered, with many candidates gaining full marks. Question 3(b) (ii) was poorly done, with few candidates recognizing the need for a transistor, and even fewer drawing the correct symbol and a current limiting resistor.

Question 5 was particularly well answered, with many candidates gaining full marks. Candidates showed clearly a thorough appreciation of recycling and environmental issues, and demonstrated a high level of expertise in the field of mobile phones. Candidates were able to clearly express their thoughts and opinions, and in part (c), the explanations were quite detailed.

Question 1

(a) Well answered with only a few candidates being confused and naming the circuit an astable.

(b) (i) Vast majority of candidates correctly identified the three components.

(ii) Generally well answered, but some candidates were not sufficiently specific about orientation to gain full marks.

(c) Well answered.

(d) Some candidates wrote about 'switching the circuit on and off', but the majority scored well.

(e) Candidates seem to improve on calculation questions every year. Nearly all the candidates correctly wrote the formula, and most made a good attempt at showing their working.

(f) Most candidates seemed to understand the concept of tolerance, and its effect on the time delay, but very few knew that the capacitor has a large tolerance relative to a resistor.

(g) (i) and (ii) Not particularly well answered.

Question 2

Most candidates generated two distinct design proposals and added good notes. A number of candidates only mentioned generic materials, and were a little vague on construction details.
This was a good scoring question. Candidates responded well to the specific requirements of the question, although the details of how to access the battery were somewhat lacking in detail.

Question 3

(a) Very well answered, with a high number of candidates gaining full marks.

(b) (i) Most candidates made reference to a lack of power, with many quoting the values of current involved.

(ii) Generally poorly answered, as discussed in the general points above.

(iii) Poorly answered.

Question 4

(a) (i) Well answered.

(ii) The majority scored quite well here, but responses were lacking in sufficient detail to gain full marks. Terms such as 'Left click', 'drag' and especially 'save' were rarely used.

(b) A wide range of responses was generated, with the majority of candidates scoring really well. Candidates seemed to have a very good knowledge and understanding of PCB design and manufacture.

Question 5

(a) A high scoring question, with answers having a high level of detail.

(b) (i) Although some candidates thought that the question referred to the case of a product, the majority scored well here.

(ii) A very well answered question, with candidates giving more than enough detail to gain the two marks.

(c) (i), (ii) and (iii) As mentioned in the general comments above, candidates scored very well here, with many gaining full marks. Candidates gave lots of detail in the explanations, and did particularly well in the section on the environment. There was very little repetition, and most of the advantages and disadvantages were sensible and clearly thought-through.

Coursework

Full Course

The Design and Technology: Electronic Products specification is an electronics design and make course with the emphasis on product design, using appropriate materials to package the electronics. Coursework consists of a project that demonstrates the candidate's ability to undertake an extended design and make activity which integrates the use of electronics and constructional materials in the creation of an electronic product.

In a number of centres, it was apparent that candidates had spent a higher number of hours working on their coursework than the 40 hours for Full Course stated by AQA. Centres need to make candidates aware of the suggested timescale when working on their coursework.

As 60% of the examination marks are allocated to the coursework, it is essential that projects reflect good practice and candidates are encouraged to stretch themselves to produce high quality designs and electronic product outcomes. Centres are reminded that 40% of the examination marks are allocated for the realisation of the project and projects should be made to the highest quality the candidate is capable of producing. The design folder represents 20% of the total examination marks and design folders should demonstrate the progress of a candidate's thinking through the use of a range of communication skills. Candidates need to be aware that the realisation is worth twice as many marks as the design folder. It was still possible in this year's examination to see design folders that were bulky and padded out with irrelevant material which must be time consuming for candidates. The key word with design folders is *quality*, not quantity, and candidates need to be made aware of the assessment stages expected within a folder. Far too often, an incomplete realisation can be found alongside an over-elaborate design folder which has taken most of the coursework time to complete.

All of the centres which were involved in the moderation process of Electronic Products this year are to be congratulated on the excellent way the coursework was presented for moderation and thanked for the hospitality extended to the AQA moderating team. Many of the centres had spent a considerable amount of time and effort on the presentation of the coursework for moderation. Many centres provided batteries and screwdrivers to assist in the moderation. Moderators were greatly helped when projects were left with screws removed or loosened ready for examination. It is pleasing to report that very few candidates used glue to seal their cases or hot glue guns to hold printed circuit boards, speakers or batteries in place. Centres need to make candidates aware of the moderation process and the need to design cases and packaging to accommodate routine maintenance and the need to change batteries.

The moderation time period is extremely tight and, although the moderation process was relatively trouble free, and centres are once again thanked for their contribution, there are a number of areas which need attention.

- **Centres are reminded that Centre Mark Sheets need to be with AQA and the moderator no later than the 5th May.**

- **Centres with twenty or fewer candidates should include all coursework folders when sending the Centre Mark Sheets to the moderator.**

- **Centres need to complete and send to the moderator a *Centre Declaration Sheet.***

- Each candidate requires a completed *Candidate Record Form* attached to the design folder.

- Candidate design folders should be individually fastened together to assist the moderation process.
- Bulky ring binders should not be sent through the post.
- Care needs to be taken by centres when using the Assessment Matrix.
- Where two or more teachers are involved in teaching Electronic Products, internal standardisation must take place.
- Centres are asked that they make a prompt response to moderators' requests by sending coursework sample material immediately by first class post.
- Moderators would be greatly assisted if the Centre enclosed a map and travel directions.

It is expected that candidates studying this specification will adopt a systems approach to designing their electronic circuits and that, for the award of higher grades A and B on the Full Course, candidates will normally have produced circuits which have process units built up from at least two basic building blocks. It has to be remembered that it is the processes that are being counted not the number of integrated circuits. A single logic Integrated Circuit (IC) or a Peripheral Interface Controller (PIC) can provide several processes.

Centres are reminded that candidates should design and make their own cases from suitable resistant materials or, significantly modify bought-in cases to demonstrate their Making skills. The product casing is expected to demonstrate the candidate's ability to design and make using appropriate resistant materials. Design of the casing may, for instance, result in the need for a particular shape and size of plastic container. A prototype of this casing could be made using vacuum forming or fabrication with suitable surface finish and internal and external detailing. Formers made by candidates for vacuum forming purposes should be kept and included in coursework for moderation. Fabrication of the casing from styrene sheets may be the most appropriate technique, especially where specialist workshops are not available. High quality prototypes can be made using a limited range of hand tools and equipment in multi-purpose rooms. The use of bought in boxes for casing may not allow candidates sufficient opportunity to demonstrate the required skills unless the boxes are significantly modified or added to by the candidate. It is emphasised that a number of centres this year allowed their candidates to spend too much time on the design and manufacture of the case in resistant materials at the expense of the electronics.

When designing, the main purpose of the design folder is to help candidates develop their ideas and to communicate their reasoning and conclusions. Electronic knowledge, skills and understanding should be the focus of the design folder. On a number of occasions, it was common to see design folders which were made up mainly of resistant materials technology, with a small amount of electronics included at the back of the folder. This resulted in candidates not being awarded the coursework grades they may have been capable of achieving.

As in previous years, it is clear that a number of centres are uncertain about what to include in their coursework to satisfy designing and making with electronic components and the specific skills and processes that could be included in a successful project. The following points have been collated from Senior Moderators' comments and observations made in centres. It is hoped that centres will find them of help in preparing candidates for future examinations in Electronic Products.

DESIGNING SKILLS

Candidates should ensure they cover the full design process and satisfy the AQA assessment criteria as stated in the specification. Candidates should evaluate their work at many stages throughout the project and not just at the conclusion of the project. Centres need to use the AQA Candidate Record Form to give feedback to the candidates on the progress of their designing and making skills.

Research - collect a wide range of electronic research material, make reference to books, data sheets, and component catalogues that the candidates have used. Carry out practical research in the form of testing circuit ideas, using kits, breadboards and computer simulation.

Analysis - break down the problem into a number of smaller problems or sub-systems. Analyse the research material and the electronic element of the problem. Use a systems approach and identify possible input, process and output devices. Use a variety of diagrams and charts, possibly supported by experimentation and, if need be, market research. The experimentation can be carried out with the use of kits or with the help of computer aided design.

Specification - a good electronic specification is crucial to the success of any Electronic Product project and will make it easier for the candidate to carry out the formative and summative evaluation. It may well be that the electronic specification is re-written a number of times as the candidate proceeds with the designing. Points worthy of consideration are the function of the system, the constraints of cost, size and time, the working parameters of input, process and output devices, a reference to power sources and assembly boards.

Generation of Ideas - involves the candidate in the gathering and exploration of circuits from any suitable resource. This can include material from books, data sheets and computer generated information. Candidates should sketch or draw out by any means, several designs e.g. three circuit ideas and two case ideas for the Full Course. Case ideas should be relatively simple and appropriate to house an electronic circuit. At GCSE level, AQA is not expecting candidates to design original electronic circuits from first principles, but rather to select and modify existing circuits to meet their needs. This will manifest itself in many ways but may involve the candidate in finding a way of interfacing a primary and secondary circuit, or changing the input and output devices, or finding a latching device, or re-designing a circuit to fit in a confined space. This type of activity will give the candidate the chance to hypothesise and carry out experiments using kits, software packages and breadboards to test their theories. It will also give the candidate the opportunity to use a range of measuring instruments and candidates should be encouraged to devise tests for their circuits and record their results.

The use of photography in a candidate's design folder enhances the folder and is an excellent record of experimental work carried out with kits and breadboards. At this stage in designing, candidates should be encouraged to apply mathematical calculations and record this evidence in their design folder. Work on potential dividers, component ratings, time delays, frequency, current drain, battery life and the size of protective resistors are a few examples of where calculations can be applied. Centres need to ensure that candidates use and apply the given formulae in the specification wherever possible in their coursework.

Development of Solution - candidates should give reasons why they have selected a certain circuit from their generation of ideas and, equally, give reasons why they have rejected the other considered circuits. It may well be that the candidate has decided to take a number of sub-systems from discrete circuits and therefore needs to explain why. Candidates should present an accurate final circuit drawing which satisfies the specification and clearly takes into account relevant research and analysis. The circuit diagram should contain sufficient information for the circuit to be made by a competent third person. Depending upon the type of assembly board to be used, the candidate should design the component layout. This can include a variety of outcomes from printed circuit boards to matrix boards and pins. Whatever method is used, it is expected that the candidate will show evidence of planning the layout of the circuit for ease of component assembly, soldering, inspection purposes, position of input and output devices and final secure positioning of the circuit board in the external package. If Veroboard is used for example, candidates should show recorded evidence in their design folders of planning the component layout, the number of link wires required and the position of the breaks in the conductive tracks, etc. Equally, candidates who intend to use a printed circuit board should show the developmental stages of their PCB layout or transparent overlay. This type of activity gives candidates of all abilities the opportunity to involve themselves in electronic design and to show what they know and can do. This method of working contrasts greatly to the trend of many candidates who find a single circuit and use it without considering whether or not it can be improved upon. Many candidates use circuits from electronics magazines which are totally unsuitable for a GCSE course in Electronic Products and consequently have little or no understanding of how their chosen circuit works and are unable to fault find if the circuit fails to operate.

Planning of Making - Many of the points mentioned in the development of the final solution also fall into the category of planning of making. Candidates of all abilities are planning and making manufacturing decisions throughout their coursework, yet, very little of it is ever recorded. Flying leads are attached to input and output devices which are superbly insulated but no record of this activity can be found in the folder. Many candidates produce an external package for their electronic system by vacuum forming and, again, no mention is made of the need for a former and the necessity for draft angles and slight radii on the corners. Candidates fabricate cases from polystyrene sheet and design and make small assembly fixtures to hold the pieces together. Decisions are made to drill holes in the flat pieces of cases prior to assembly but, unfortunately, no record of these activities can be found in the folder. Planning of making should be well attempted by candidates of all abilities but, sadly, it is often omitted by even the most able of candidates.

Evaluation, Testing and Modification - involves the candidate in testing the project in the environmental conditions it was designed for and to see whether or not it will meet the demands of the specification. This part of the design process was poorly attempted by a significant number of candidates and is partly due to candidates completing their projects very close to the 5th May AQA deadline date. Centres need to make sure that candidates have sufficient time to complete this important section and to encourage candidates to think up interesting ways of testing their projects and the recording of the results, using block diagrams, pie charts, pictograms, etc. Alarms are very popular projects and if, for example, a candidate designs an anti-theft alarm for a bicycle the scope for testing and evaluation are immense. Once again, the use of photography can be encouraged to record testing and to highlight any suggested modifications to the system. This section of the assessment criteria is possibly the only place in the design folder that a candidate can carry out an extended piece of writing and gives candidates the opportunity to reflect upon the whole process. Candidates need to be made aware that there are five marks available for the Quality of Written Communication and, with reasonable care, most candidates should be able to gain three to five marks for this aspect of their coursework.

Use of Communication, Graphical and Use of I.C.T. Skills. - throughout their design folders, candidates should be encouraged by centres to show a wide range of communication skills and techniques and use information technology and appropriate software packages to generate circuit diagrams and printed circuit board overlays and the simulation of circuits on screen.

Social Issues, Industrial Practices and Systems and Control (including the use of CAD) -
As the emphasis on industrial and commercial practices in the new Design and Technology specifications has increased, it is reasonable to expect candidates from all types of centres making use of the facilities that these applications offer. Although the resources available to centres varies from one centre to the next, the resources in the most well equipped centres cannot compare to the facilities available to modern manufacturing companies. When candidates are designing and making their coursework projects, they are naturally limited to using the facilities available in the centre. If, for example, CAD/CAM is available, candidates should try and apply it in a relevant way to their project work. If CAD/CAM is not available, candidates need to demonstrate an understanding of their application in an industrial setting and be able to compare and make recommendations on how their coursework would change or be influenced if CAD/CAM was used.

As the candidates proceed to design and make their coursework projects, they should be encouraged to contrast their centre based work patterns against industrial work patterns for a similar task. Evidence of industrial practices should flow through the design folder and not be an addition at the end of the folder simply to show its use. The gathering of evidence for industrial practices can be presented as bullet points on relevant pages, or short statements. The key to candidate success is making industrial practices relevant to the project and involving the candidates in reflective thinking and comparisons.

Evidence of Industrial Practices

CAD - Circuit design and testing
CAD - PCB design and mask
CAD - Design of cases
CAM - PCB mask and PCBs
CAM - Manufacture of cases

Scale of production – one off, batch and mass production

Production Methods
Pick and place component assembly machines
Vacuum forming machines
Injection moulding machines
Laser cutting machines
CNC machines
Jigs and fixtures

Inspection Methods and Equipment
Quality Control
Quality Assurance

Systems and Control **-** As electronic circuits are examples of a system and all have some kind of control, it should therefore be possible for all candidates to cover systems and control within their electronic design and making coursework.

Social Issues - As electronic systems become more sophisticated and cheaper to purchase than ever before, they will interact more and more upon society. Many of these interactions will benefit society greatly. Sadly, some will not and will cause massive disruptions to society and individuals. The world of electronics has already impinged upon the emergency services, the home, medical services, industry, commerce, leisure, entertainment, education, scientific research, shops, offices, transport and weather forecasting. Candidates should be able to describe the possible implications for society, including advantages and disadvantages of the interaction with the electronic age. Much of the information will come from newspapers, magazines, television reports, class videos and teacher handouts.

REALISATIONS

Each year, moderators report that a number of candidates achieved low grades as a result of not completing a project which was too difficult for them to attempt or not suitable for the Electronic Products specification. Centres should endeavour to match the appropriateness of a project to the ability of the candidate and the Electronic Products specification. It is advantageous to the candidate, both academically and motivationally, to complete a project and see it working.

Building Quality Assurance into Coursework

Although centre workshops and laboratories are vastly different to the facilities available to manufacturing companies, nevertheless, candidates can still consider and include aspects of Quality Assurance into their work.

When designing the PCB mask, candidates should always make the circuit as small as it is practically possible. Yet, it must be remembered that AQA will not withhold grades if a candidate designs a large PCB. It is a question of getting the balance right. A very small PCB can be extremely difficult to populate and solder. Candidates should make sure that the tracks of the PCB are wide enough to carry the required current and withstand the etching process. The size of pads should be big enough to assist the soldering process. Where possible, the PCB mask should be designed with all common components, for example, diodes, resistors and capacitors next to each other as this will greatly speed up the assembly time.

All flying leads can be anchored to the PCB by strain holes, thus adding a mechanical joint to assist the soldered joint. Input and output devices such as Switches and Light Emitting Diodes can be insulated and stop the possibility of shorting the circuit. The PCB and battery should be held secure in the case with easy access when changing the battery.

It is common to find candidates making the tracks of printed circuit boards very thin and pads very small and then having great difficulty in trying to solder components in place. Many a poorly soldered circuit is the result of a badly designed printed circuit board and centres should try to remove the minimum amount of copper the circuit design will allow.

Moderators reported that a small number of centres had used electronic modelling kits and breadboards in the candidates' final realisation. Centres are reminded that the use of these kits is more appropriately assessed in the designing criteria than the making criteria. A small number of moderators reported that several candidates had completed electrical projects which did not include any active electronic devices. The attention of centres is drawn to the difference between an electronic project and an electrical project and that it is expected that the electronic circuit will be hard wired and components soldered in place. It is also apparent that a number of centres are allowing candidates to work with circuits powered by mains electricity. AQA stresses that this should be avoided as the Electronic Products specification can be delivered without the need of this type of electrical supply.

Peripheral Interface Controllers (PICS)

Many more candidates are using PICs in their coursework projects than in previous years. Centres need to remind candidates who are intending to use PICs, of the assessment stages contained within the Assessment Criteria and to ensure that candidates address them. The tendency with some candidates is to state right from the beginning of the design folder that they are planning to use a PIC and no further thought is given to alternative ways of solving the problem. Candidates preparing coursework for Electronic Products should be using a systems approach and identifying the building blocks for the INPUT, PROCESS and OUTPUT sections of the system and, if a PIC is chosen as the most suitable building block for the process section, it should be arrived at by way of investigation.

Areas of concern with the use of PICs in centres:

Candidates are not providing a range of electronic design ideas.
Candidates are not providing evidence of PIC programming.
Candidates are using the same PIC program.
Candidates are using identical PCB designs.
Candidates are using commercially made bought in PCBs.
Many candidates who use PICs are not fully satisfying the Assessment Criteria.

Short Course

The main body of text for the Full Course also refers to the Short Course but the following specific points should also be noted.

It was apparent in a number of centres that candidates had spent a higher number of hours working on their coursework than the 20 hours stated by AQA for the Short Course specification, and they may have been better suited for entry to the Full Course. Indeed, a considerable number of candidates had produced coursework of a standard good enough to satisfy the higher grades of the Full Course.

Candidates are expected to adopt a systems approach to designing their circuits and may achieve the higher grades with high quality use of process units made from a single building block circuit. As a guide, candidates should produce two electronic circuit ideas and one case idea.

Mark Ranges and Award of Grades

Full Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	68.6	24.7
Coursework	95	210	121.5	42.5
Foundation tier overall 3541/F	--	350	190.1	56.6

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	125	86	74	62	51	40
	scaled	140	96	83	69	57	45
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	210	133	106	80	53	27
Foundation tier scaled boundary mark		350	221	184	147	110	73

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	78.6	20.7
Coursework	95	210	172.2	31.0
Higher tier overall 3541/H	--	350	250.8	43.9

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	125	101	92	83	74	62	-
	scaled	140	113	103	93	83	69	-
Coursework boundary mark	raw	95	95	84	72	60	48	-
	scaled	210	210	186	159	133	106	-
Higher tier scaled boundary mark		350	308	277	246	216	176	156

Provisional statistics for the award

Foundation tier (6435 candidates)

	C	D	E	F	G
Cumulative %	33.1	58.0	75.1	86.0	93.6

Higher tier (6905 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	7.8	30.2	58.0	80.7	94.7	97.1

Overall (13340 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	4.0	15.6	30.0	57.7	77.0	86.5	91.8	95.4

Short Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	100	120	57.4	21.7
Coursework	95	180	100.4	36.4
Foundation tier overall 3551/F	--	300	157.8	47.4

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	100	73	59	46	33	20
	scaled	120	88	71	55	40	24
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	180	114	91	68	45	23
Foundation tier scaled boundary mark		300	185	151	118	85	52

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	100	120	76.0	14.5
Coursework	95	180	150.9	26.6
Higher tier overall 3551/H	--	300	226.9	36.2

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	100	86	79	72	65	55	-
	scaled	120	103	95	86	78	66	-
Coursework boundary mark	raw	95	95	84	72	60	48	-
	scaled	180	180	159	136	114	91	-
Higher tier scaled boundary mark		300	278	249	220	192	157	139

Provisional statistics for the award

Foundation tier (156 candidates)

	C	D	E	F	G
Cumulative %	29.5	57.7	75.0	84.0	92.9

Higher tier (198 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	4.0	31.8	65.2	84.4	94.9	94.9

Overall (354 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	2.3	17.8	36.4	60.7	78.5	86.2	90.1	94.1

Definitions

Boundary Mark: the minimum (scaled) mark required by a candidate to qualify for a given grade. Although component grade boundaries are provided, these are advisory. Candidates' final grades depend only on their total marks for the subject.

Mean Mark: is the sum of all candidates' marks divided by the number of candidates. In order to compare mean marks for different components, the mean mark (scaled) should be expressed as a percentage of the maximum mark (scaled).

Standard Deviation: a measure of the spread of candidates' marks. In most components, approximately two-thirds of all candidates lie in a range of plus or minus one standard deviation from the mean, and approximately 95% of all candidates lie in a range of plus or minus two standard deviations from the mean. In order to compare the standard deviations for different components, the standard deviation (scaled) should be expressed as a percentage of the maximum mark (scaled).