Version 1.1.: 20/12/2005

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Secondary Education

Design and Technology: Electronic Products (3541/3551)

Examiners' Report

2005 examination - June series

- Full Course
- Short Course
- Coursework

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General.*

Contents

Electronic Products

This page has been left intentionally blank

General comments

Overall the quality of response from candidates to the examination papers was extremely encouraging. Centres are to be congratulated on their preparation of candidates, along with candidates being entered for the correct written paper tier. Examiners reported that all centres appear to be teaching the full specification, and that all candidates had access to most of the marks.

Full Course – Higher Tier

General

Questions 1, 2, 3 and 7 proved accessible to candidates of all abilities with the remaining questions testing the more able.

The clarity and presentation of candidates' responses was much improved, perhaps reflecting the revised layout of the paper.

Question 1

All three parts of (a) were well answered, but a number of candidates struggled with (b)iii to identify the correct block. In (c) most candidates identified one resistor correctly and many realised that the frequency / pitch of the sound was going to change.
In (d)(i) many candidates confused breadboard and veroboard in their comparison. The PCB layout in part (d)(ii) was generally well attempted, although there were occasional mistakes with identifying the correct pin numbers.

Question 2

Whilst this question was well answered by the vast majority of candidates, some responses lacked the appropriate detail. In (a) statements given were often simply specification points rather than analysis. Parts (b) and (c) were well answered. The specification statements in (d) were answered well, although the electronic statements were sometimes a little vague.

Question 3

Candidates showed evidence of better preparation for this type of question compared with the previous year. Part (a) was well answered with a wide range of responses; however, a number of candidates still provided generic materials in (a)(ii), whilst a disappointing number of responses such as 'gluing the circuit in place' were seen in (a)(iii).
Some candidates described issues related to soldering rather than case construction in (b) whilst in (c) many responses related to testing and how it could be improved rather than the method of evaluation. Part (d) saw many vague and general responses.

Question 4

Part (a) was well answered but some candidates put the Logic Gates in the wrong order. Few candidates gained full marks for (b). In (c), the truth table was usually well answered, but there were some very mixed responses to (c)(ii) with few candidates scoring full marks.

Question 5

The quality of answers varied greatly to this question. The responses in (a) showed limited understanding of the reasons for using PICS as part of a solution.
There were many good answers to part (b), but a number of candidates also gave unnecessary detail without fully answering the question.

Question 6

Overall the responses to this question showed better preparation by centres. Part (a) was rather poorly answered although most candidates recognised that the relay was connecting different circuits.
Part (b) was well answered.
In general, candidates tackled the calculation in (c) in an organised manner.

Question 7

The examiners accepted a wide interpretation of 'the environment'. Many good quality and detailed answers were provided by candidates, showing an improved understanding of this aspect of the specification.

Full Course – Foundation Tier

General

There seemed to have been far fewer questions that were not attempted than in previous years, and the design element of the paper was particularly well answered. Candidates demonstrated good manufacturing knowledge, but a minority of centres had candidates who struggled with the basics of the subject, for instance circuit symbols, logic and PCB design.

Question One

There was a wide standard of answer to (a). Most candidates recognised the LED, bulb, buzzer and PTM switch, but a high number could not name or draw the LDR or transistor.
Part (b) was generally well answered, except for (vi), naming the thyristor, with many candidates writing transistor. Clearly, there seems to be much confusion between the transistor and thyristor.

Question Two

The E12 series has not, it would seem, been covered by a number of many centres, as few candidates got this question right. 300R and 300R was a very common answer.
In (b) most candidates gained 2 marks for writing the formula and substituting values, but few candidates then went on to resolve the calculation. Part (c) was well answered.

Question Three

This was a high scoring question for the majority of candidates. The 'when used' part was particularly high scoring and, although some candidates struggled a little to express themselves clearly, the advantages of using ICT were identified by most.

Question Four

Part (a) was well answered.
The level of response for (b) was generally very good, although in one or two cases the answers given did not really relate to the research, and were more of a specification point.
In part (c) most candidates gained two marks, naming specific aspects of the case design that would be influenced by research and analysis, such as weight, size, cost, visual appeal etc.
In (d) the casing specification was well answered, with candidates writing clear aims, and then justifying them. The electronic specifications were a little less clear. Candidates often wrote a vague aim, and then failed to give a reason for that aim.

Question Five

Part (a) (i) was a high scoring question for the vast majority of candidates. Sketches were clear, and the annotation was much more detailed than in previous years. Candidates added two switches, and labelled them correctly.
In (a)(ii), some candidates name generic materials and thus failed to score as highly as possible.

(a)(iii) Candidates responded quite well; many centres now appear to use sensible and practical methods of fitting LEDs and securing PCBs. Examiners were pleased to see candidates also writing about steps taken during production, e.g. drilling 5mm. holes for LEDs, and drilling holes for PCB pillars.
Most candidates scored very well in part (b), but some failed to read the question carefully, and wrote about safety issues of the case itself, or hazards associated with the manufacture of the circuit.

In general, (c) was well answered. Most candidates scored two marks by writing that the dice could be given to a child, and asking for their opinion. Physical checks, such as a drop-test, a soak test or using the dice for a lengthy period, were quite rare.

Part (d) was well answered by the majority of candidates, who scored highly.

Question Six

The quality of response to (a) was varied, although many candidates had little difficulty in naming the gates and completing the truth tables.
Part (b) also provided a wide range of responses. Most candidates scored at least 2 marks by adding an OR gate to the two lift inputs. Many candidates added a NOT gate to the 'doorway' input, although this was not necessary. It was pleasing to see that most candidates scored two marks for the quality of drawing.

Question Seven

Parts (a) and (b) were well answered.
In (c) (i) a large percentage of candidates circled the 555 and the capacitor.
Most candidates in (c)(ii) wrote of a change in sound, and usually a change in volume. Very few noted that the frequency would decrease.
Very few candidates seem to have heard of veroboard in (d)(i), whilst in (d)(ii) it was generally well answered, and most centres appear to have prepared their candidates well. The quality of drawing was also good.

Question Eight

This question was well answered by the majority of candidates. Although some wrote only about the advantages of ICT in general, many expressed themselves well, and the 'disadvantage' section was particularly good.

Short Course – Higher Tier

General

The paper proved to be very accessible for the vast majority of candidates, and the impression gained was that centres had prepared candidates well for the examination. The majority of candidates gained well over 50 marks, and many candidates scored very highly indeed. Questions requiring a written response were answered well, and candidates were expressing themselves with clarity and a good level of detail. Question 3, the analysis, research and specification question, was particularly well done, with many candidates scoring maximum marks. The quality of sketching in question 4 was very good and candidates annotated their designs well. The flow chart question was attempted by all candidates, but here, the level of response was quite varied. Clearly, some centres had not covered that part of the specification dealing with the programming of PICS, but candidates did, in the main, show some degree of understanding of the problem.

Question One

Part (a) (i) and (ii) were very well answered.
Examiners were very pleased with the standard of response to the frequency calculation in part (b). Virtually all candidates transferred the formula from the front of the booklet, and most centres had taught their candidates to solve this type of question. The units were also generally correct.
Very few candidates gained the 1 mark in part (c).
Part (d)(i) was very well answered. The majority of candidates also responded well in d(ii), giving a good level of detail. In (d)(iii) candidates seemed to respond better than in previous years. Some candidates still place more than one wire in one hole but, generally, this was a high scoring question.

Question Two

(a) Very few gained the single mark, with candidates not appearing to have read the question with sufficient care.
(b) (i) Examiners reported that many candidates scored at least 4 marks. Candidates correctly drew the resistor / capacitor network and drew the correct connection to pins 6 and 7. The resistor and PTM to pin 2 confused some candidates, but the drawings were generally very neat and accurate, thus scoring another mark.
(ii) Most centres had prepared their candidates well to answer the frequency calculation and the answer was well structured. Nearly all candidates wrote the formula, substituted and manipulated very clearly, and remembered to add the units.

Question Three

(a) Very well answered, with candidates giving good detail
(b) A high scoring question. Candidates were keen to give lots of detail, and clearly understood the purpose of research.
(c) Candidates scored well on this question and wrote about specific details of the design that would be affected by research and analysis, e.g. appearance, size, cost, weight etc.
(d) (i) A high scoring question. Candidates identified a point, and went on to give a reason, thus scoring full marks.
(ii) Some answers were a little vague and not very 'specific'

Question Four

(a) (i) The standard of sketching and annotation was very good. Candidates seemed to spend a large amount of time on their answers, and had perhaps used time gained from other questions, which is considered to be a good idea.
(ii) Specific materials were usually given, and only a few candidates gave generic materials in the answer.
(iii) Although some sketches were a little confusing, most candidates demonstrated their ideas clearly, and it would seem that most centres have adopted sensible and practical methods of fitting LEDs and circuit boards.

(b) A high scoring question, although a few candidates did not read the question carefully, and wrote about safety issues of the case itself, or with regard to manufacturing the circuit board.
(c) Most candidates scored two by reference to giving the dice to a child and seeking an opinion, but many candidates referred to testing during manufacture, and not to physical tests that could be given to the finished dice.
(d) Generally well answered.

Question Five

(a) Well answered by candidates from the majority of centres, yet some centres appear not to have covered the advantages and disadvantages of using PICs.
(b) A wide range of responses for this question. Most candidates seemed able to draw upon personal experiences; therefore the basic commands and sequence were correct. A high number of candidates incorporated at least one element of feedback in their flow chart, and perhaps one third made reference to 'pause' or 'wait'. The quality of drawing gained two marks for the vast majority of candidates.

Question Six

Some candidates failed to gain any marks, as their answers did not relate to the environment, but commented solely on the advantages of ICT in general. Candidates are again reminded to read questions very carefully. However, the majority did score well, and the answers had good detail and relevance.

Short Course – Foundation Tier

General

The paper proved accessible for the majority of candidates, and there was a wide range of marks awarded. There were only a small number of candidates who did not attempt the majority of questions. Questions that required a written response were generally well answered, with candidates trying hard to express themselves clearly.
Question 2, the analysis, research and specification question, was answered well, with many high-scoring responses.
The sketches asked for in question 3 were reasonably well done, but many candidates seemed to rush their responses. There is still a significant number of candidates who seem to struggle with basic issues, such as circuit symbols and names of components and subject vocabulary, and hence, question 1, 4(a) and 4(b) were answered surprisingly poorly.
Question 3(b) was very well answered, but some candidates failed to read the question carefully, and wrote about safety issues of the product itself, or safety factors to be considered during the manufacture of the circuit board, and not the case.

Question One

(a) A number of candidates scored very well, but many candidates lacked accuracy in the drawing of the symbols.
(b) Well answered, except for the thyristor.
(c) Most responded with 600R, but many failed to write the formula given at the front of the answer booklet.
(d) Well answered.

Question Two

(a) Most candidates attempted to give a detailed response, instead of just a simple statement.
(b) Generally well answered.
(c) Candidates tended to answer a little vaguely, therefore the majority only scored one mark.
(d) The casing specification was answered very well, with candidates focusing on safety issues, visual appeal etc. and most gave a reason for their specific points. The electronic specifications were a little unclear.

Question Three

(a) (i) A well answered question. Some sketches were untidy and hurried, but the level of annotation was much improved this year, and most candidates scored two marks for the quality of communication.
(ii) There are still candidates who name a generic material and thus do not gain full marks.
(iii) It was pleasing to see the majority of candidates referring to sensible and practical methods of fitting an LED and securing a circuit board. LED clips, or bezels, are in wide use, and candidates mentioned the need to drill holes prior to fitting. Similarly, candidates wrote quite clearly about the method of securing the PCB, although quite a lot of sketches were not very clear and were rushed and untidy.
(b) Generally well answered, yet a few candidates misread the question and wrote of hazards in respect of the case itself, and not the manufacturing process.
(c) Candidates wrote in very general terms about the evaluation of the finished dice. Most scored two by reference to giving the dice to a child and noting what the child thought about it, but very few other methods of evaluation were mentioned.
(d) Similarly, candidates here wrote in general terms, but the majority scored well.

Question Four

(a) Well answered.
(b) Another well answered, with the exception of part (iii), with many candidates thinking that the siren controlled the frequency of the sound.
(c) (i) Very few candidates scored well here, with the majority indicating that the 555 and the loudspeaker controlled the frequency.
(ii) Most candidates recognised that there was some change in the sound, but very few wrote about frequency. Most wrote about a change in volume.
(d) The majority attempted the question, but there were few candidates who scored full marks. There were a lot of answers which had tracks touching, and some confusion about the pin numbering of Integrated Circuits.

Question Five

(a) Most candidates scored well for the 'when used' part, but a good number struggled to express the advantages in a clear and coherent way.
(b) The majority of candidates picked up a few marks here. Clearly, some centres had covered the social and environmental issues in the specification well, but others had not, and here candidates wrote mainly about computers and their uses.

Coursework

Full Course

All of the centres which were involved in the moderation process of Electronic Products coursework in 2005 are to be congratulated on the excellent way candidates' work 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, screwdrivers and, in some cases, written instructions describing how the projects worked which assisted in the moderation. Moderators were greatly helped when projects were left with screws removed from cases or loosened ready for examination. It was also helpful to moderators when PCBs were removed from PCB pillars allowing for the inspection of soldering and circuit build quality. 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 with appropriate annotation and grades for each assessment stage.

Candidate design folders should be individually fastened together in a logical order to assist the moderation process.

Bulky ring binders should not be sent to the moderator.

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.

Moderators are greatly assisted if Centres enclose a map, travel directions, and a contact name.

Centres should not request verbal feedback from visiting moderators.

The Design and Technology: Electronic Products specification is an electronics design and make course with the emphasis on product design and 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. The coursework project should not exceed 40 hours for the Full Course.

In a number of centres, it was apparent that candidates had spent a higher number of hours working on their coursework than 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. It was still possible in this year's examination to see design folders that were bulky and padded out with irrelevant material and far exceeded the suggested timescale of 14 hours. 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. Equally, centres need to make sure that their candidates are aware that the realisation is worth **twice** as many marks as the design 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.

Candidates need to balance the time spent on developing and making the electronics part of their project against the time required for the casing. It is important to remember that this is a Design and Technology: 'Electronic Products' specification and therefore greater emphasis should be given to the electronics. As a guide, the coursework should always be weighted in favour of the electronics. Although no precise figure can be given due to the nature of outcomes across candidates' work, a ratio of 70:30 or 60:40 in favour of electronics should deliver the balance to satisfy the coursework requirements for this specification.

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. As a guide, candidates should produce three electronic circuit ideas and two case ideas.

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 ability. 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 casings is acceptable but may not allow candidates sufficient opportunity to demonstrate the required skills unless the boxes are significantly modified or added to by the candidate. With a purchased case, it is the work in modifying the basic case to accommodate the electronic system which gains the credit. It is emphasised that a small 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 were capable of achieving.

A higher number of centres than in previous years set a single coursework project theme, an example being the design and manufacture of an alarm system. Although this is acceptable, and a number of centres use this approach successfully each year producing a wide range of very different electronic circuits and cases, the evidence from this year's moderation shows that some centres, by setting a single theme, are restricting the candidates' individual responses when designing and making. It was common to see a whole group of candidates with the same analysis, research, circuit ideas and an identical or very similar PCB. Most of the research and circuit ideas consisted of photocopied material with no comment by the candidate to justify its inclusion or an explanation of how it will be used, modified or rejected. In these circumstances, a lack of annotation by centres also made moderation difficult as it was not always clear to see where grades had been awarded to candidates whose work, although very similar in content and quality, had been given very different grades. On a number of occasions, this resulted in a centre's coursework having to be re-marked and candidates' grades adjusted. Centres need to endeavour to offer a range of projects or to ensure that a single project theme will enable candidates across the ability range the opportunity to fully demonstrate their designing and making capabilities.

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 target market, the constraints of cost, size and time, the working parameters of input, process and output devices, a reference to power sources, assembly boards, packaging of the electronics and environmental issues.

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. 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 Veroboard. 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, etcetera. 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 and web sites 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 the circuit if it fails to operate as expected.

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 brightest 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 is poorly attempted by a significant number of candidates and is partly due to candidates completing their projects very close to the 5 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 or pie charts. 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 is 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, printed circuit board overlays, the simulation of circuits on screen and the design of cases to package the electronic circuit.

Social Issues, Industrial Practices and Systems and Control (including the use of CAD) -
As the emphasis on industrial and commercial practices in the 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 when designing with electronic components by referring to a systems diagram.

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 dangerous 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 Range and Award of Grades

Full Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	75.0	26.2
Coursework	95	210	123.0	41.7
Foundation tier overall 3541/F	--	350	197.98	56.83

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	125	91	79	68	57	46
	scaled	140	102	88	76	64	52
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	210	133	106	80	53	27
Foundation tier scaled boundary mark		350	227	190	153	117	81

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	89.8	19.8
Coursework	95	210	173.6	29.4
Higher tier overall 3541/H	--	350	263.42	40.92

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	125	106	98	90	83	71	-
	scaled	140	119	110	101	93	80	-
Coursework boundary mark	raw	95	95	84	72	60	48	-
	scaled	210	210	186	159	133	106	-
Higher tier scaled boundary mark		350	318	285	255	226	186	-

Provisional statistics for the award

Foundation tier (5801 candidates)

	C	D	E	F	G
Cumulative %	33.8	58.5	75.2	86.7	93.3

Higher tier (6146 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	7.8	32.3	61.0	83.0	96.1	97.7

Overall (11947 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	4.0	16.6	31.4	59.1	77.8	86.8	92.4	95.6

Short Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	100	120	68.2	19.4
Coursework	95	180	98.2	42.1
Foundation tier overall 3551/F	--	300	166.40	51.08

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	100	77	66	55	44	33
	scaled	120	92	79	66	53	40
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	180	114	91	68	45	23
Foundation tier scaled boundary mark		300	194	162	130	98	66

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	100	120	88.6	13.5
Coursework	95	180	161.9	18.7
Higher tier overall 3551/H	--	300	250.43	26.33

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	100	94	87	80	74	66	-
	scaled	120	113	104	96	89	79	-
Coursework boundary mark	raw	95	95	84	72	60	48	-
	scaled	180	180	159	136	114	91	-
Higher tier scaled boundary mark		300	286	257	229	202	170	-

Provisional statistics for the award

Foundation tier (64 candidates)

	C	D	E	F	G
Cumulative %	28.1	50.0	60.9	71.9	84.4

Higher tier (138 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	5.8	44.2	79.0	96.4	99.3	100

Overall (202 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	4.0	30.2	54.0	74.8	83.7	87.6	91.1	95.0

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).