RECOGNISING ACHIEVEMENT

GCSE

Design & Technology (Systems & Control)

General Certificate of Secondary Education **GCSE 1957**

Report on the Components

June 2006

1957/MS/R/06

Oxford Cambridge and RSA Examinations

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General Certificate of Secondary Education

GCSE Design and Technology: Systems and Control (1957)

REPORT ON THE COMPONENTS

GCSE Systems & Control

General

It was good to see a general improvement in the work submitted by candidates. The better candidates are showing an excellent command of all aspects of the Systems and Control specification.

On two of the foundation papers, core and mechanisms, the average score has gone down. An examination of the candidates' responses showed a worsening of the technical knowledge. In order to make the papers accessible to all candidates many questions relate to processes and techniques which should be found in workshop activities. Centres need to look carefully at previous papers to see the range of knowledge which the candidate must understand.

Industrial applications and understanding is an area where again candidates' knowledge is lacking. Centres must ensure that the idea of a prototype, which is the first of a batch, is embedded into the knowledge and understanding of the subject. If a candidate is able to approach the mini projects in year 10 with an industrial focus they should appreciate the use of a jig to aid the manufacture of a batch.

For the lower scoring candidates a basic vocabulary of technical terms was seen to be missing. Teachers should avoid the use of colloquial statements when describing a situation and use the correct technical vocabulary at all times. Candidates need to build upon their learning at Key Stage 3 to enable them to approach this examination at an appropriate level. The core paper does need a better level of understanding.

The other industrial aspect is CAD/CAM where it is expected candidates will have used or have direct experience of the processes. On all option papers the cross-over questions relate to this area and were poorly answered. It is important for the candidates to be involved in CAD/CAM to gain an understanding of how the process can be used, from initial setting up, through the machining operation, to a finished product so that they are then able to discuss the relative benefits of the whole operation.

1957/1 and 1957/2

General Comments

The selection of candidates for an appropriate tier was a key factor in their performance. Selection was, in the majority of cases, well considered. There were still a number of candidates who were incorrectly entered for the Higher Tier who attained very low scores. Centres should note, for example, that the design questions on the Higher Tier offer limited support information. These questions demand an independent approach to design, and as such are inappropriate for weaker candidates.

The ability of candidates to communicate their ideas in the form of clear notes and sketches was varied. Many candidates who were successful organised their sketches to show both a main idea for their design, and supporting details, to which were added relevant notes. Candidates who used this approach were able to demonstrate clearly how their design idea addressed each requirement within the design questions and in doing so ensured good access to the mark scheme.

Questions relating to the use of SMART materials were answered quite well.

The topic of manufacturing in quantity was addressed well by candidates from the majority of Centres. The overall responses demonstrated an improvement in understanding of these topics, although this improvement was most marked from the Higher Tier candidates. It is important that all candidates understand the basic principles behind the use of generic C.N.C. machines such as a milling machine, lathe, and router. The question relating to quality control checks which need to be made during manufacture was answered better than in previous years. The majority of candidates were able to correctly offer a specific inspection, or measurement check, which was relevant to the product considered (a screw-in-stud from a sport boot).

Efforts have been made to improve access to the questions. This has been done by altering the style of language used and, in some cases, making changes to the structure of the question. It was disappointing to see a number of candidates offering one word answers as a response to questions which asked them to 'give a reason', or to 'explain', their answer. Such limited responses are insufficient to enable candidates to gain marks.

FOUNDATION

Question 1.

(a) The question provided a good introduction to the paper, and was answered well by almost all candidates. Many candidates correctly offered a specific material, which was pleasing, although a number of candidates incorrectly offered 'rubber' as a response to a material for the wheels. Such candidates were likely to have confused the word 'wheel' to mean 'tyres', and not the rims as indicated by the diagram.

(b) The majority of candidates gave the correct answer, 'screw'.

(c) The majority of candidates correctly named a suitable tool.

(d) A majority of candidates correctly gave at least one correct response

(e) (i) Almost all candidates were able to offer a suitable safety precaution.

(ii) Incorrect responses involved checks made after the forming process had been completed.

<u>Question 2.</u>

(a) This question was generally well answered. A common error was to suggest the use of screws in the place of nuts and bolts.

(b) Many candidates incorrectly offered only one word answers, or used poor sentence construction. This made communication difficult. Too many candidates failed to identify the specific advantages of a jig and instead only offered inadequate generalised responses.

(c) Generally this question was well answered. However a number of candidates offered imprecise drawing, while for others the absence of a label made it impossible to award a mark.

(d) Most candidates gained a mark by demonstrating an appreciation of the principle of lubrication. A small number of candidates offered the idea of a bearing as a response and this also gained a mark.

Question 3

(a) The level of response for this question was generally satisfactory. A number of candidates were not aware of the principles of ergonomics, or basic theory relating to the multiplication of a force.

(b) Most candidates were able to achieve two of the marks here, but many were unable to provide a suitable process.

(c) This part of the question was very well answered. A majority of candidates gained both marks.

(d) (i) The majority of candidates were able to identify the component shown.

(ii) This subject area was not understood. Very few candidates offered any response.

(d) This question was very well answered, and the majority of candidates gained a mark.

Question 4.

(a) Candidates in general demonstrated poor communication skills on this question. Many candidates presented circular arguments using the text given in the stem of the question, which failed to gain marks.
Many successful candidates explained the function of the lenses, but few offered a practical advantage to sports people.

(b) Answered well by those candidates from Centres who had obviously prepared well for this part of the Specification.

(c) (i) A number of candidates gained credit for knowledge of the property of shape memory alloy, but very few made reference to the needs of sports people. A large number of candidates incorrectly thought the shape memory alloy would be shaped specially to grip the individual contours of the user's head.

(ii) Many candidates failed to respond to the specific requirements of the question, and incorrectly made general statements relating to the recycling of plastics or metals.

(iii) The relative advantages between metals and plastics, as specifically asked for in the question, were not always given.

(d) Generally this question was well answered.

(e) This question differentiated well between candidates – one mark was gained by many, but only the better candidates were able to offer a second correct response.

Question 5.

(a) (i) Overall a good level of response was given. A number of candidates incorrectly offered 'router' as a response.

(ii) Answered well by most candidates.

(b) (i) Overall a satisfactory level of response was given; however, many candidates incorrectly gave "vacuum forming" as a response.

(ii) Few candidates focused upon the specific part, a 'screw-in stud'. Too many candidates incorrectly resorted to the use of stock one word answers such as 'easier' or 'quicker'.

(c) Overall the responses to this question were good, and showed a marked improvement over previous years. Many candidates correctly offered specific quality control checks.

(d) This part of the question was less well answered.

(e) Generalised advantages of CAD/CAM were often incorrectly given without making any reference to the benefit to the designer, as specifically asked for in the question.

HIGHER

Question 1.

(a) Candidates in general demonstrated satisfactory communication skills on this question. Many successful candidates correctly explained the function of the lenses, but some candidates failed to gain both marks by not giving a practical advantage to sports people.

(b) Answered well by those candidates from Centres who had obviously prepared well for this part of the Specification.

(c) (i) A number of candidates gained credit for knowledge of the property of shape memory alloy, but very few made reference to the needs of sports people. A large number of candidates incorrectly thought the shape memory alloy would be shaped specially to grip the individual contours of the user's head

(ii) This part of the question was answered well and many candidates gave correct responses which were well structured. A small number of candidates failed to respond to the specific requirements of the question, and instead incorrectly made general statements relating to the recycling of plastics or metals.

(d) Generally this question was well answered.

(e) This question differentiated well between candidates – one mark was gained by many but only better candidates were able to offer a second correct response.

Question 2.

(a) (i) Overall a good level of response was given. A small number of candidates incorrectly offered 'router' as a response.

(ii) Answered well by most candidates.

(b) (i) Overall a good level of response was given, however a small number of candidates incorrectly gave 'vacuum forming' as a response.

(ii) Few candidates focused upon the specific part, 'a screw-in stud'. Too many candidates incorrectly resorted to the use of stock one word answers such as 'easier', or 'quicker'.

(c) Overall the responses to this question were very good, and showed a marked improvement over previous years. Many candidates correctly offered specific quality control checks.

(d) Many candidates gained one mark but few were able to gain both marks. The most common correct answer related to the lack of damage to the stud offered by the tool shown.

(e) Generalised advantages of CAD/CAM were often incorrectly given without any reference being made to the benefit to the designer, as specifically asked for in the question.

Question 3.

(a) Answered well by most candidates.

(b) Answered well by most candidates.

(c) Most candidates were able to gain credit here but many were unaware of the symbol for a buzzer.

(d) Many candidates were able to gain one mark for the correct suggestion of a variable resistor but then did not explain the relevance of this to switching on the output at different light levels.

(e) This part of the question was answered well by most candidates and reflected a good level of practical experience.

Question 4.

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

(ii) Answered correctly by many of the candidates but a number were unaware of the names for the types of motion and produced descriptive answers.

(b) Little knowledge of the process of fabrication was in evidence. Most incorrect answers related to the properties of brass.

(c) (i) Answered well by most candidates.

(ii) Unfortunately poor quality sketches and notes were often evident. Some designs were overly complicated and gave no indication as to how they worked.

Question 5.

(a) A majority of candidates were able to gain credit here.

(b) (i) Poor quality sketches and notes made it difficult for some candidates to communicate their ideas. The majority of successful candidates produced a main sketch with additional supporting details, to which were added the relevant notes. Candidates who used this approach were able to easily demonstrate how their design idea addressed each of the requirements in the design question and in doing so ensured good access to the mark scheme.

(ii) Of the candidates who attempted this section, many were able to achieve a large proportion of the marks

1957/3 and 1957/4

Papers 3 and 4

General Comments

The papers produced a spread of marks across almost the full range.
As in previous years Papers 3 and 4 included questions on CAD / CAM and product analysis as the two overlap questions answered by both tiers of candidate. The majority of candidates had attempted all questions though legibility of responses does remain a problem in a few cases.

The use of generic responses, e.g. 'cheap', 'quick' or 'easy', is still prevalent among a minority of candidates. In most cases such unqualified terms will not be enough to gain a mark. Comparison between alternatives will usually result in the mark being awarded.

Practical processes such as soldering were generally well known but there was a tendency on the part of some candidates to use colloquial terms rather then technically correct vocabulary.

One area that was generally answered poorly was the identification of IC pin numbers in question 3 of the Foundation Paper. The specification requires that candidates have a chance to use and handle integrated circuits, thus gaining knowledge of the pin notation.

The technique of using a breadboard for circuit development seemed to be an area of difficulty for some candidates. Although simulation software is readily available in most centres the actual building of a test circuit is a technique that candidates should at least be aware of.

The question on relay pins in the Higher Tier proved difficult for many candidates; the use of relays is a feature of many coursework projects and candidates can expect to find reference to them in the written papers.

The second overlap question, which was based on the analysis of a smoke detector, was successful in providing clear differentiation at the higher end of the Foundation Paper. The device was familiar to candidates and they were able to draw on their own knowledge in addition to the information provided in the question.

Foundation Tier

1 (a) (i) The switch types appeared to be familiar to the majority of candidates, who gained full marks for correct identification.

(ii) Very few errors appeared in naming the switches with return actions. Candidates should be aware that if only one name is required and they give two, one of which is incorrect, the mark would not be awarded.

(b) Advantages of a soldered joint were mainly related to the security and permanence of it but a number of marks were lost through failure to recognise the ease of removal of the spade terminal. Few responses recognised the fact that no heat was involved

(c) (i) The majority of candidates picked **B** as the correct view.

(ii) Cleaning the iron and wiping on a sponge were widely recognised as part of the tinning process; the main error was the description of soldering a joint rather than tinning the iron. A few responses indicated that tin was the substance added, rather than solder.

2 (a) (i) Reference to the longer expected life of an LED gained one mark as did reference to the different colours and shapes available. No mark was awarded

for reference to the space required as LEDs and filament lamps are available in a range of sizes.

(ii) The need for a protective resistor was widely known but it was often described as 'preventing the LED from blowing up', rather than limiting current.

(iii) The dimmer light level resulting from too high a value of resistor was recognised by slightly less candidates.

(b) Responses to this part of the question were generally poor, breadboarding did not seem to be fully understood, The LED being reversed was spotted by most but few identified the missing connection from resistor to positive rail. Marks were awarded to those candidates who had indicated the position of the errors on the diagram.

(c) (i) Adjustment of the setting point for the op-amp output was not widely appreciated but allowance was given to those who had referred simply to adjustment of the circuit.

(ii) Recognition of the 'one way flow' nature of the diode was rewarded with a mark though very few candidates noted the protection provided against incorrect connection of the battery. Most put increase in reading for thermistor heating. There was some confusion between an LED and a diode, which led to candidates thinking that the component was a warning device.

(d) (i) Knowledge of the effect of heat on the resistance of an NTC thermistor was not common; the majority stated that the resistance increased.

(ii) There appeared to be very little knowledge of adhesives amongst candidates. Frequent errors referred to solder, glue or unsuitable adhesives that would be affected by heat. Trade names of epoxy resin were all accepted.

3 (a) (i) Storage of charge was understood.

(ii) Clear specification points relating to the function of the device were not widely recognised.

(b) The position of pins 6 and 14 highlighted the lack of experience of IC's for many candidates. The most common error was to correctly count down one side from pin 1 and then to count down the opposite side instead of following the pins round in an anti clockwise direction.

(c) (i) Interpretation of the output graphs given for alternative timing circuits was a good discriminator for more able candidates. A large number of responses correctly stated that the minimum length of output pulse was not dependent on the time that the switch was pressed.

(ii) Use of a larger capacitor was the correct response most commonly found, rather fewer candidates mentioned using a resistor in series with R1.

(d) (i) Few candidates correctly identified the NOR gate.

(ii) Few candidates knew that joining the inputs of a NOR gate will turn it into an inverter.

(iii) Surprisingly correct responses could be found to this part even though the NOR gate had not been correctly identified. Either a NOT, inverter or NAND were acceptable as alternatives.

4 (a) This part of the question was well answered; knowledge of the benefits of a CAD system for PCB design was widely recognised.

(b) (i) Few candidates realised that the increased cost of moulded lettering resulted from the expense of mould / tool manufacture or that once the mould is produced any changes to lettering are extremely difficult.

(ii) The fact that the label could be removed with the inherent danger that warnings were no longer available was widely recognised.

(c) Environmental effects resulting from manufacturing were well recognised and the majority of candidates gained marks for this part.

(d) (i) With the exception of those candidates who suggested making the board larger this was a well answered part of the question.

(ii) The height of components was frequently mentioned though rather fewer responses mentioned the effect that this would have on the casing design. The better responses also mentioned the size of other essential components such as the battery, which were not included in the diagram.

5 (a) (i) The question was centred on the reasons for choosing the stated production method but this was often misinterpreted and mention was made of visible features of the casing such as the test button, or other design aspects were considered.

(ii) The required property related to the need for the clips to flex or bend when the battery is inserted. A number of candidates related their answer to the holding of the battery as shown in the diagram; this is a function of the clip rather than a property.

(b) The majority of candidates responded well to this part of the question, gaining both marks.

(c) (i) A common fault with this part was to mention removal of the part rather than assembly. As these devices are not readily repairable it is not intended that they should be dismantled.

(ii) This part of the question differentiated well, better candidates realising that the screw head shown is intended to prevent removal with a standard screwdriver.

(d) Knowledge of components that require correct orientation was generally good.

(e) This final part to the question was well answered with the majority of candidates gaining at least one of the marks.

Higher Tier

1 (a) This part of the question was well answered; knowledge of the benefits of a CAD system for PCB design was widely recognised.

(b) (i) Responses at the Higher level were significantly better than Foundation; expense of mould / tool manufacture being recognised, there were again few responses referring to the difficulty of making changes once the mould has been produced.

(ii) The fact that the label could be removed with the inherent danger that warnings were no longer available was widely recognised.

(c) Environmental effects resulting from manufacturing were well recognised and the majority of candidates gained marks for this part.

(d) (i) This was a well-answered part of the question.

(ii) The height of components was frequently mentioned. The better responses also mentioned the size of other essential components such as the battery, which were not included in the diagram.

2 (a) (i) The question was centred on the reasons for choosing the stated production method but this was often misinterpreted and mention was made of visible features of the casing such as the test button, or other design aspects were considered.

(ii) The required property related to the need for the clips to flex or bend when the battery is inserted was generally well answered.

(b) The majority of candidates responded well to this part of the question, gaining both marks.

(c) (i) A common fault with this part was to mention removal of the part rather than assembly. As these devices are not readily repairable it is not intended that they should be dismantled.

(ii) The majority of candidates realised that the screw head shown is intended to provide a tamperproof fixing.

(d) Knowledge of components that require correct orientation was generally good.

(e) This final part to the question was well answered with the majority of candidates gaining both of the marks.

3 (a) (i) The question asked for functional points to be identified; The majority of candidates made this distinction; some however used economic points or mentioned the relative size of the devices.

(ii) Very few responses recognised the need for steady light and many candidates were unaware of the need for the LDR to be kept clean in order to give an accurate reading.

(iii) This part was generally well answered.

(b) (i) The majority of candidates could describe the purpose of a relay sufficiently to gain the mark.

(ii) The fact that the relay would be constantly switching on and off was recognised though descriptions of the result were at times vague.

(c) (i) The calculation was well answered by most candidates, with very few failing to include the working and the majority gaining at least one mark.

(ii) This part of the question was badly answered by the majority of candidates. Knowledge of how a relay operates along with correct names for the pins was rarely found.

4 (a) (i) A number of candidates knew how to draw a square wave but failed to gain marks because frequency and the number of pulses were incorrect. A number of sine waves were also encountered.

(ii) A range of responses was accepted for interpretation of the graph and the majority of candidates gained a mark.

(iii) A high proportion of correct answers to this part, mainly from those who had also gained marks in the previous part.

(b) As with the Foundation Paper a high proportion of candidates appeared unfamiliar with the use of a breadboard. Those who had used one invariably gained both marks.

(c) (i) This question involved a procedure that many candidates will have used in coursework. Very few gained both marks but a good proportion realised that for accurate calibration the desired temperature had to be reached.

(ii) Those who had encountered the PIC microcontroller generally gave good responses; there were a number who relied on the generic terms such as ‘cheap’ and ‘small’.

5 (a) (i) A good response in general, showing familiarity with commonly used sensing devices.

(ii) Many candidates seemed unaware of contact bounce or the need for a clean signal with a voltage level matching the input requirement of the IC.

(iii) Use of debouncing circuits such as an RS bistable or a Schmitt device with a capacitor was not commonly found in the responses. Use of a Schmitt device alone was rewarded with one mark.

(b) (i) A significant number of candidates successfully converted the binary number to denary.

(ii) The majority of candidates who had gained a mark in the previous part were able to give a reason for not using binary as the final display.

(c) A number of errors were noted in responses to this final part of the question. The main cause of lost marks was misinterpretation of the schematic diagram with a few candidates attempting to jump tracks over an existing track without using a link wire.

1957 / 05 & 06

General Comments

In general the standard of written responses was the same as in 2005. However, there were some scripts that were very difficult to read. Some candidates failed to gain high marks for drawing / sketch responses. Questions referring to mounting brackets for cylinders and operating linkages are intended to reflect the activities a candidate should have experienced through their own designing and making lessons.

Foundation

1. (a) Sections **B** to **F** were generally well done. Some candidate drawings for **D**, the single acting spring return cylinder, omitted a spring. Some candidates drew a correct shuttle valve but many had omitted to put in the ball.
   (b) Only a few candidates described correctly the use of a shuttle valve. In this application, it enabled the door to be opened from either side.

2. (a) Most candidates named component **A** correctly.
   (b) (i) The addition of a uni-directional flow restrictor to the circuit was done correctly by many candidates. Some candidates scored fewer marks when they drew the ball and seat the wrong way round.
   (ii) Most candidates knew that the spring returned the cylinder, but failed to mention that the ball 'blows-off' its seat allowing the rapid release of air pressure and the quick return of the cylinder.
   (iii) Very few candidates mentioned that the cylinder would start to close as soon as the push button was released.

3 This question was generally well answered.
   (a) (i) Many candidates described correctly the action of the 'safety valve'
   (ii) Very few candidates stated that the 'drain valve' was for getting water/oil out of the system. Many said it drained the air.
   (iii) Most candidates described the need for a regulator and a gauge.
   (iv) Many candidates stated that air is 'stored' with some candidates referring to the application of 'time delay'. Few candidates referred to the need to retain sufficient air pressure when the compressor was off.

   (b) Many candidates referred to a safety requirement. Some said that pipes could 'flay around' with a few candidates referring correctly to air bubbles getting into the blood stream.

4 This question was generally well answered. Some candidates had difficulty in distinguishing between using CAD to draw and using computers to simulate a system operating.
   (a) Answers including able to copy and paste components, easy to draw and save images, make changes quickly and store and retrieve gained the most marks.
   (b) Candidates that referred to the testing of the integrity of the circuit, the viability of different components, solving problems through simulation, and cheaper compared with building the circuit for real, gained the most marks.
   (c) Many candidates recognised that the change would mean a smaller workforce and a workforce who were trained in IT skills.

(d) (i) Most candidates recognised that the magnetic piston ring provided the input to trigger the sensors

(ii) Some candidates said that **X** and **Y** would change but did not say that there was a signal output from **12** on the computer that energised the solenoid valve

5 Most candidates gained some marks for this question. The quality of sketching varied from excellent to very difficult to interpret.

(a) Some candidates did not design for the up and down movement and some did not use the threaded part of the piston rod. The published Mark Scheme gives an exemplar response that could be used to show future candidates.

(b) Very few candidates explained how the pressure decay circuit works. Most thought that a signal was sent to the diaphragm valve to make the door shut. The published mark scheme contains an exemplar description that could be used in lessons on pressure decay circuits with students.

Higher

1. This question was generally well answered. Some candidates had difficulty in distinguishing between using CAD to draw and using computers to simulate a system operating.

(a) Answers including 'able to copy and paste components', 'easy to draw and save images', 'make changes quickly' and 'store and retrieve' gained the most marks.

(b) Candidates that referred to the testing of the integrity of the circuit, the viability of different components, solving problems through simulation, and cheaper than building the circuit for real, gained the most marks.

(c) Many candidates recognised that the change would mean a smaller workforce and a workforce who were trained in IT skills.

(d) (i) Most candidates recognised that the magnetic piston ring provided the input to trigger the sensors

(ii) Some candidates said that **X** and **Y** would change but did not say that there was a signal output from **12** on the computer that energised the solenoid valve

2. Most candidates gained some marks for this question. The quality of sketching was generally very good.

(a) Some candidates did not design for the up and down movement; some did not use the threaded part of the piston rod. The published mark scheme gives an exemplar response that could be used to show future candidates

(b) Only a few candidates explained how the pressure decay circuit works. Most thought that a signal was sent to the diaphragm valve to make the door shut. The published mark scheme contains an exemplar description that could be used in lessons on pressure decay circuits with students.

3. Most candidate sketches were very clear and communicated well. Some candidates however, failed to continue to draw in the same plane.

(a) Most candidates gained some marks for the design of a connector. Few included a locknut to prevent the piston rod from unscrewing. A form of yoke or fork with a clevis pin is the correct response that was required from candidates.

(b) Some candidates managed to realise that a slotted eye was required on the end of the link to enable a rigidly mounted cylinder to operate fully. Of those who drew a slot only few included a washer in the connection.

(c) A variety of correct responses to locking devices were seen. Some candidates however, incorrectly appear to think that 'welding' is suitable for all applications.

4. (a) Most candidates scored some marks for the calculation. Some candidates failed to recognise the 32mm as a diameter and put 32 into the formula instead of 16. Sadly, many candidates could not work out the area of a circle despite the given formula on page 4 in the (inserted) 'Formulae Sheet'. A few candidates completed a calculation that gave answers from 0.12 to 0.13 but failed to get the final mark for the units of N/mm^2

   (b) About half the candidates who responded to this part of the question realised that the piston rod was the cause of this problem. The original calculation was based on the full area of the piston; but on the instroke, there is less area of the piston for the pressure to act on so less force is produced.

   (c) Nearly all candidates knew that raising the air supply pressure would solve the problem.

5. (a) Many candidates drew a diaphragm valve but not always connected correctly forgetting the restrictor on the low pressure supply.

   (b) There were many good answers to this part of the question, with many candidates expressing in their own way what happens with the air bleed occlusion in this application. Unfortunately a small number of candidates gave a view that the air bleed would open the door.

1957 07 / 08

General comments

Centres appear to have taken greater care when entering candidates this year, there being much less evidence of candidates having been entered for an inappropriate tier.
Few candidates failed to attempt to answer all questions although it is clear that many candidates in the foundation tier have a very weak knowledge of technical detail and, in particular, mechanical components and their functions.
Candidates' poor drawing skills continue to hamper their ability to give convincing answers for which examiners can give credit in the design questions.

Foundation

1 (a) While most candidates were able to correctly identify and label linear and rotary motion, many were unable to give oscillating motion for the movement of the head.

(b) Although many candidates were able to recognise the need for a cam, an appropriate extension to the neck with a pivot point was less commonly seen.

(c) It was encouraging to note that a significant number of candidates could name a hardwood and suitable finish for the toy, although MDF did appear frequently. Candidates' knowledge of the properties of hardwoods, however, is limited and many answers tended to be general safety points for toys rather than properties of the material.

(d) Candidates who were able to consider the mechanical function of the toy correctly observed that the rubber tyres would give greater traction.

2 (a) The majority of candidates were able to give a good reason for the use of a card model to test the function of the proposed mechanism.

(b) Most candidates were able to give a suitable component that would hold the card pieces together at the pivots, the most popular being paper fasteners and butterfly clips although there were several other large headed components that were acceptable. Two commonly given components that were not acceptable were dowels, because these would fall out easily, and split pins which have very small heads.

(c) There were some good attempts at solutions for returning the hand lever to make contact with the paddle, but many solutions failed to gain full marks because they lacked detail. Candidates should be advised that when answering mechanical questions, details of the mechanism including components and fixings should be shown.

(d) As it is an expectation that candidates design and use jigs in their coursework it was disappointing to see how few candidates appear to understand the requirements of a simple drilling jig or are able to transfer their practical experience.

3 (a) Candidates were generally unable to identify the classes of levers correctly in the two examples given.

(b) Many candidates wrongly assumed that the calliper brake would result in uneven braking, but those who suggested that uneven wear of the pads may be the result were given credit. The best answers related to the reduction in effort needed in the centre pull system.

(c) Few candidates were able to calculate the mechanical advantage and then apply this to arrive at the braking force. . Centres are advised to ensure that candidates practice the application of simple mechanical formulae.

(d) Most candidates were able to give a practical reason for the sliding brake fitting, most commonly for adjustment purposes. Part (ii) was less well answered, however, with candidates' knowledge of the use of keys, keyways and splines for the prevention of twist being weak. Some candidates modified the fitting to show flat surfaces for which they were given credit.

4 (a) Candidates' lack of knowledge of CNC and CAM in general continues to be a cause for concern. Few could name a CNC machine and of those who did, 'milling machine' was the most common correct answer.

(b) The most common acceptable answer given for the reason for batch production related to the fact that small numbers were required.

(c) Responses to this question were hampered partly by candidates' weak drawing skills but also by the lack of technical detail. There were many vague references to buttons, catches and springs for the retention or ejection of the key, showing that the candidate had little idea of how they would work or whether they would cause further hazard.

5 (a) The majority of candidates could give acceptable answers for the advantages of the trigger cramp over the G cramp but some candidates failed to address the instruction to consider the mechanical features.

(b) The majority modified the jaw by drawing concave curved faces for which they were awarded one mark. Candidates who gave V shaped grooves gained two marks.

(c) Polymorph is a readily available modern material and as such it was disappointing to note that very few candidates had any idea of how it could have been used in the development of the handle.

(d) There were some good responses to this question with candidates addressing most of the specification points. Again however, weak drawing skills did prevent them from communicating some ideas effectively.

Higher

Questions 1 and 2 are common questions with paper 7 and generally the quality of responses is significantly higher.

1 (a) At this level candidates appear to be much more aware of CNC machinery although some failed to consider the product and incorrectly named a CNC lathe.

(b) Candidates were more likely to show some knowledge of setting up a CNC machine, the most common response given being the depth of cut.

(c) Many candidates understood the concept of the ability to respond quickly to demand and the need to make easy changes.

(d) There were many good quality sketches with candidates responding to the specification points, although some solutions tended to add further hazards.

2 (a) Higher tier candidates generally gave good answers which addressed the mechanical features of the cramps.

(b) Responses to this question were very similar to those given by the foundation tier candidates, the majority giving curved jaws.

(c) Knowledge of polymorph is better in this tier with some candidates referring to the low temperature moulding and remoulding.

(d) Some well drawn and annotated solutions which addressed the specifications well, although the ability to remove the jaw with ease was not always addressed.

3 (a) Some candidates suggested that the disc brake was more efficient but were unable to explain this to gain full credit. It was perhaps surprising that few candidates were

able to suggest that rim brakes would be more likely to pick up dirt and water, reducing friction and therefore, efficiency.

(b) The process and output stages of the disc brake system were understood and well answered. Many candidates, however, wrongly suggested in the input stage that water or air are contained in the hydraulic system, or suggested that the pipe moved and pressed on the disc.

(c) Energy conversion was well understood.

(d) Many candidates misread the question and described why adjustment of the braking system was necessary. Although candidates referred to the use of the threaded sleeve to lengthen or shorten the cable, rarely did any candidate show understanding of the use of the locknut.

(e) The need for and use of lubrication was well understood with the majority of candidates giving the need for prevention of friction between the cable and inner sleeve.

4 (a) Most candidates were able to give the gear ratios which they could apply to the speed of the rear sprocket correctly. However, the majority were unable to calculate the road speed, failing to appreciate the need to calculate the circumference of the wheel before applying the rotational speed of the wheel.

(b) Many candidates were able to suggest that the swinging arm was to tension the chain, but for the full marks they needed to explain that the tension needs to change as a result of gear changing.

(c) There were some good solutions given which clearly addressed the need to attach and secure the gear change assembly.

5 (a) Although there were some good solutions given by many candidates, often candidates failed to consider the size of the drill stand and attempted over complex solutions including rack and pinion adjustment which, although addressing the height adjustment, did not secure the drill arm to the pillar.

(b) Candidates' failure to read the question correctly again resulted in over complex attempts to draw rack and pinion systems. The question asked for a simple lever system and was aimed at testing the candidates' knowledge of levers including pivot points, load points and effort.

(c) Few candidates were able to explain in a way that convinced examiners that they had a real understanding of what a lever as a mechanical component is and how it functions in a system.

1957/9

General Comments

A wide range of projects is now developed by Centres, giving candidates the opportunity to follow interest lines. Quality of the whole project continues to improve with many design folders showing good use of ICT. There is still a worry about the systems approach to designing, a significant number of candidates do not use the INPUT-PROCESS-OUPUT model when proposing design solutions and later developments.

The key stage 3 strategy is beginning to have an influence in some sections of the folder. The whole method of product analysis has much to offer us when looking at similar products. The same style was then carried through to the specification, with the same headings, to appraisal of the ideas and finally to the evaluation of the prototype.

Many Centres are now comfortable using the full breakdown of marks for all the assessment objectives.
The volume of the folder is still causing some concern with the occasional 100 pages. Centres need to get candidates to use their time more effectively targeting work for the marks available. The 40 hours overall guide time should indicate some approximate time for each assessment objective given 100 marks total for work carried out.

Objective 1: Identification of a need or opportunity leading to a Design Brief
Centres are now judging the time well and keeping this section to a few pages. Candidates could have more details about the problem area they are looking at. Certainly a mood board with illustrations would set the scene for customer and clients.

Objective 2: Research into Design Brief leading to a Specification
Candidates did not recognise the need to further explore the Design Brief and explain the background to the problem.

The better surveys started with an action plan of the information the candidate expected to gather. A meaningful questionnaire will relate to options and variations in the product where the customer/client group can influence how the designs develop. It is pleasing to see some Centres putting together data which is important for the future design activity, such as anthropometric data for the customer group and specific sizes for components which must be used – batteries, key switches, output devices etc.

The whole research data needed pulling together in a conclusion indicating the most important findings of the research carried out. This work leads comfortably into a specification, meaning sections are not pulled out of the blue but are related to the need of function and the customer/client.

Objective 3: Generation of Ideas
Many Centres encourage candidates to produce a good range of ideas based around the specification. Some candidates are showing just the casings and variations around switches and controls. More creative thinking needs to be displayed and the use of an initial mind map to develop solutions should be encouraged.
The design proposals must be clearly systems products. In higher scoring folders this approach is used formally with headings to show the three parts. Where the system and casing structure is proposed, immediately the candidates are displaying a range of appropriate solutions.

Appraisal of the ideas should be based around a product analysis with clear comments about form and function. The customer/client identified in the design brief should be considered when thinking about the usability of the proposed design. These selection comments must be more than good and bad analysis or a scoring system where little is known about the value of the numbers.

The display of the ideas continues to improve, with a variety of communication techniques used. There is a danger of having too many CAD drawings to the detriment of hand methods. It has been interesting to see a high level use of ICT in some Centres contrasting with poor pencil drawings.

At the end of this objective candidates must make the selection of the final idea completely clear. At the highest levels a selection drawing is made pulling together all the separate parts of casing and system with some commentary about function, materials and construction.

Objective 4: Product Development
Modelling of the product as a 3-D item would help more candidates develop thinking on improving their initial ideas. For electronics it is pleasing to see that a large number of Centres are still building circuits on breadboards with photographs as evidence of work. The use of ICT modelling for circuits does allow candidates to make changes, develop and improve. Modifications are rarely proposed after the modelling exercise.

There is little investigation evident when making reasoned decisions about materials, production methods and selection of components. It is a major strand of the assessment scheme and one where little work is carried out. Even if materials are mentioned there is no reasoned selection process. The candidate should take the time to state the options for construction for the whole project. It is in this section where unnecessary theory pages are reproduced about construction.

Industrial application is the weakest section, too often being shown as an abstraction from a textbook. The candidate has the opportunity to design and produce a control system for the future batch production of the prototype. This section needs to be at candidate level, not industrial and specific to their project. The control item can be very easily produced as a template, simple jig, mask for PCB, etc. To address the mark scheme in AO6 it is vital the candidate uses the control system.

The candidate must ensure there is a full working drawing with full details about the final product to be made. The drawings should be more than just a PCB and a case, and are expected to show the layout of all switches, cable runs and battery retention. Too often at the end of the section many decisions are yet to be made. Equally there is often a big jump in the folder from the initial final idea to a final drawing, where the candidate has not produced evidence of the development process. Certainly when designing a PCB there should be some of the intermediate stages showing defects which are improved upon.

Objective 5: Production Planning and Realisation
Centres have now recognised the importance of the planning strand with many candidates producing a wide range of evidence. Flow diagrams in many forms are seen in folders. To get to the highest mark levels candidates must look beyond the order of work to include tools and equipment with some comment about quality control for their product.

It is useful to see some discussion of health and safety issues showing full understanding of safe working procedures.

The quality of the final product is generally improving. It is vital the candidate can complete the whole making process. There are occasions when the project is very complex and the candidate fails to complete the product. Centres need to guide candidates at an early stage to ensure they are carrying out a realistic project. It is good to see many less ‘electronics magazine’ projects where both candidate and teacher are unable to fault find problems.

Objective 6: Evaluation and Testing
This is still the weakest section of the assessment scheme. More use was made of the specification with varying degrees of success. The higher scoring folders carried a full product analysis, with inclusion of a comment about the available resources.

Meaningful testing was rarely carried out. Testing can be workshop based using available equipment or fellow students. The customer/client must be considered for the highest mark levels. The future development of the product for the next prototype should be given.

If the control system was used in AO5 comments for improvements that can be easily carried out should be included.

Presentation
Most Centres use the performance criteria to judge the overall presentation of the folder. On the whole the marking was realistic to the content of the folder. The highest performance should reflect a concise folder organised in a logical way.

General Certificate of Secondary Education (D&T) (1957)

June 2006 Assessment Series

Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
01	50			26	22	18	14	10
02	50	30	25	20	15			
03	50			28	24	20	17	14
04	50	29	24	19	14			
05	50			32	25	18	11	4
06	50	31	24	18	11			
07	50			23	19	16	13	10
08	50	30	25	21	16			
09	105	85	73	62	50	38	27	16

Syllabus Options

Foundation Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				97	81	65	49	33
Percentage in Grade					20.9	24.4	23.5	14	10.5
Cumulative Percentage in Grade					20.9	45.3	68.7	82.8	93.3

The total entry for the examination was 629

Higher Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	138	122	105	89	70	60		
Percentage in Grade		8.39	29	55.7	79.1	93.7	97.1		
Cumulative Percentage in Grade		8.39	20.6	26.7	23.5	14.5	3.4		

The total entry for the examination was 1110

Foundation Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				93	77	61	46	31
Percentage in Grade					19.5	22.9	25	20.3	7.9
Cumulative Percentage in Grade					19.5	42.4	67.3	87.6	95.5

The total entry for the examination was 498

Higher Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	139	124	107	91	72	62		
Percentage in Grade		9.4	30.8	58.4	82.8	94.9	97.7		
Cumulative Percentage in Grade		9.4	21.4	27.7	24.4	12	2.8		

The total entry for the examination was 898

Foundation Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				103	83	64	45	26
Percentage in Grade					20	23.1	18.5	13.9	18.5
Cumulative Percentage in Grade					20	43.1	61.5	73.4	93.9

The total entry for the examination was 65

Higher Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	146	127	108	89	68	57		
Percentage in Grade		7.5	34.3	29.9	16.4	9	3		
Cumulative Percentage in Grade		7.5	41.8	71.6	88.1	97	100		

The total entry for the examination was 67

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	5.6	13.6	17.3	22.4	17.1	10.7	6.1	3.7
Cumulative Percentage in Grade	5.6	19.2	36.5	58.9	76	86.6	92.7	96.3

The total entry for the examination was 3267

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