OCR
RECOGNISING ACHIEVEMENT

GCSE

Design & Technology (Systems & Control)

General Certificate of Secondary Education **GCSE 1957**

Report on the Components

June 2007

1957/MS/R/07

Oxford Cambridge and RSA Examinations

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All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

The reports on the Examinations provide information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content, of the operation of the scheme of assessment and of the application of assessment criteria.

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 870 6622
Facsimile: 0870 870 6621
E-mail: publications@ocr.org.uk

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General Certificate of Secondary Education Systems & Control (1957)

REPORTS ON THE COMPONENTS

Report on the component taken in June 2007

Chief Examiners General Comments

At a time when it would be thought that this qualification would be settling down, there is evidence that responses by candidates have been very variable. Certainly some excellent coursework has been completed, but there is a growing proportion which was not complete. When completing the written papers there are the same disparities.

Centres must recognise the broad range of technical and graphic communications language needed for GCSE. In the middle and lower levels some candidates do not score marks because the drawings are so poor examiners cannot decipher the intention of the answer. Also inappropriate responses are evident with non technical answers.

There has been a noticeable trend of incorrect entry with candidates being entered for the higher tier, perhaps because their coursework indicates a higher grade than C. The result is very low scores on the higher paper where candidates are unable to display their knowledge and understanding on the higher level questions. There have been a number of candidates scoring 10 of less.

The use of ICT is becoming very well integrated within coursework, candidates are really using it as a tool to display ideas and in simulation of systems. On the question papers where candidates have used a range of ICT equipment as a part of mini projects or the coursework they are able to answer questions about applications.

Industrial applications continue to cause concern, candidates should be familiar with using jigs or templates to control small batch production. The design of jigs to control production should have been seen by candidates within the mini projects in year 10. Simple bending and drilling jigs should be a normal part of workshop activity.

1957 / 01 & 02 Core Papers

GENERAL COMMENTS

Responses to the Foundation Paper [1957/01] generated a wide range of marks this demonstrated that the paper offered a good level of differentiation. Compared to previous years there were a greater number of high scoring candidates, which was pleasing. Responses to the Higher Paper [1957/02] produced a narrower range of candidate's marks. Unfortunately too many candidates attained low scores in the range 0-10, and fewer candidates produced high scores compared to previous years. The higher scoring candidates found no one question too difficult to answer but instead lost a small number of marks throughout the paper.

The selection of candidates for appropriate tiers was a key element to their performance. Selection was, in the majority of cases, well considered with the vast majority of Centres entering candidates for the correct tier. The significant number of candidates who attained low scores in the range 0-10 on the Higher Paper demonstrated incorrect entry of tier. Schools should note, for example, that the design questions [Q4 and Q5.] on the Higher Tier offer limited support information, these questions demand an independent approach to design, and as such are inappropriate for weaker candidates. Centres should bear these comments in mind when deciding candidate entry.

The ability of candidates to communicate their ideas in the form of clear notes and sketches was satisfactory overall. The majority of candidates added notes to their sketches when required to do so, which increased access to the marks available to them. Candidates from the majority of centres used a single central diagram with linked 'satellite' sketches to communicate specific detail. Centres should note that candidates often find it difficult to communicate responses to all of the design requirements in a question by producing a single sketch. Our advice is for candidates to practice answering past design questions using the method of a single central diagram with linked 'satellite' sketches.

PAPER 01FOUNDATION

Question 1.

(a) The introductory question was answered well, with most candidates achieving 2 marks.
(b) Answered well by most candidates. A common incorrect response was 'screw' in place of the correct response which was 'bolt'.
(c) This question was answered well by almost all candidates.
(d) Not attempted by a number of candidates (some candidates may have possibly missed this part of the question due to layout of the Paper).
(e) Most candidates were able to gain marks here.
(f) Answered well by most candidates.

Question 2.

(a) Answers demonstrated a poor understanding of the principles for the equilibrium of forces.
(b) Answered well by most candidates, although a common error was to only label the direction of the winding handle and not, in addition, the pulley.
(c) Answered well by most candidates.
(d) Overall responses were poor with few candidates able to name a dowel joint.
(e) Answered well by most candidates.

Question 3

(a) As in previous years this type of question was well answered. Most candidates were able to gain two marks here.
(b) Answered well by most candidates.
(c) (i) Answered well.
(ii) Generally this part of the question was not well answered. The level of response needed was best answered in terms of considering the effect of the component on the current. Few candidates gained the second mark.
(d) Many candidates successfully substituted the values into the given formula, basic errors in the application of mathematics however caused few candidates to gain the second mark.

Question 4.

(a) Few candidates applied relevant knowledge from the Specification to generate a logical answer here. Too often candidates simply referred to 'danger', or to 'cars blowing up'.
(b) Answered well by a number of candidates. Clearly a number of Centres had prepared well for this part of the Specification, and here candidates applied taught knowledge. The most common misconception was that the gears were needed to make a connection between the motor and the wheels rather than explaining the effect they have in controlling the motion.
(c) Well answered overall.
(d) Answered well by the more able candidates with an appreciation of the factors affecting ergonomics.
(e) This part of the question gave good opportunity for differentiation. Lower attaining candidates focussed upon the cost of materials while higher attaining candidates correctly considered manufacturing in quantity
(f) Poor appreciation of the problems involving recycling of products made from different types of material.
Few candidates gained full marks here. The significance of the words in the question 'problems to overcome' was missed by the majority who responded with general learnt answers on the environment.

Question 5.

(a) Generally answered well. The most common incorrect response was that 'rechargeable batteries do not need to be disposed of'.
(b) A good working knowledge of mechanisms was evident, but a number of candidates incorrectly thought an improvement would be to alter the positions of axles.
(c) Answered well, only by those centres studying CNC machining.
(d) Students who had set up and operated C.N.C. machines would have been in a strong position to answer this question. Common incorrect responses included; 'use stronger cutting tools' and, 'alter the sheet thickness'.
(e) Poor knowledge of quality control was in evidence here. Specific control checks were needed. Generalised quality control checks e.g. "Check the size" gained no marks.
(f) (i) Polymorph was not well known as a SMART material.
(ii) As to be expected at this stage of the examination paper, only the more able candidates were able to gain credit here.

PAPER 02 HIGHER PAPER

Question 1.

(a) A good number of candidates applied relevant knowledge from the Specification to generate a logical answer here. A number of candidates incorrectly referred to 'cars blowing up'.
(b) Answered well by a number of candidates. Clearly a number of Centres had prepared well for this part of the Specification, and here candidates applied taught knowledge. The most common misconception was that the gears were needed to make a connection between the motor and the wheels rather than explaining the effect they have in controlling the motion.
(c) Well answered overall.
(d) Answered well.
(e) A small number of candidates incorrectly focussed upon the cost of materials while a larger number of candidates correctly considered manufacturing in quantity.
(f) A good number of candidates demonstrated an appreciation of the problems involving recycling of products made from different types of material. Too many candidates gave incorrect standard comments relating to environmental problems instead of focussing upon the problems raised in the question.

Question 2.

(a) Generally answered well. The most common incorrect response was that 'rechargeable batteries do not need to be disposed of'.
(b) A good working knowledge of mechanisms was evident, but a number of candidates incorrectly thought an improvement would be to alter the positions of axles.
(c) Answered well, only by those centres studying CNC machining.
(d) Students who had set up and operated C.N.C. machines would have been in a strong position to answer this question. Common incorrect responses included; 'use stronger cutting tools' and, 'alter the sheet thickness'.
(e) (i) Improved knowledge of quality control was in evidence here, when compared to previous years.
    (ii) Specific control checks were often correctly given. Generalised quality control checks e.g. "Check the size" gained no marks.
(f) (i) Polymorph was not well known as a SMART material.
    (ii) As to be expected at this stage of the examination paper, only the more able candidates were able to gain credit here.

Question 3.

(a) (i) Most candidates showed a good knowledge of the vacuum forming process.
    (ii) There was some evidence that a small number of candidates had responded incorrectly by giving answers which considered the properties and shape of the hull rather than those of the mould.
(b) Most candidates were able to gain some credit here.
(c) Poor quality sketches and notes were too often produced. Some designs were overly simplified and demonstrated a poor working knowledge of fixings and adhesives.

Question 4.

(a) (i) A good number of candidates gave correct responses here.
    (ii) Answered correctly by many of the candidates but some were only aware of one plastic forming process, the incorrect response of vacuum forming was often given.
(b) Most candidates were able to gain some credit here.

(c) Properties of jigs were better understood than in previous years but many candidates did not consider the economic factors as requested in the question.
(d) Poor quality sketches and notes were too often given. Some designs gave no indication of how they worked. [See 'General Comments].

Question 5.

(a) Many candidates were able to gain credit for showing an electric motor but failed to make any note about its function. Many gear systems did not show or provide a note to describe the reduced motion of the driven gear. At this level of question in the paper candidates need to carefully consider and apply knowledge from the Specification.
(b) Many candidates gained credit for the successful sketch and description of a simple electrical circuit but were unable to provide details of a double pole switch. Many final solutions would have created a short circuit for the battery.
(c) Poor quality sketches and notes made it difficult for candidates to clearly communicate their ideas.

1957 / 03 & 04 Electronics Papers

General Comments

The papers produced a wide spread of marks with the majority of questions being attempted by candidates in the Foundation Tier; Higher Tier candidates had rather more gaps on their papers with, in some cases complete questions being left unanswered. There were a number of candidates in the Higher Tier who would clearly have benefited from entry to the Foundation Tier. It is worth Centres remembering that the last two questions on this paper are targeted at grades A and A*.

Once again the overlap questions on the papers, targeted at D and C grades respectively covered CAD / CAM and product analysis. There were some good responses to these two questions from both Foundation and Higher Tier, showing that candidates had clear knowledge of the product design process and were able to offer reasoned arguments in their responses. There were also a significant minority, particularly in the Foundation Tier who failed to read the questions properly and consequently lost marks for irrelevant responses.

Legibility of responses continues to cause problems when marking but every effort is made to decipher each response and credit is given wherever possible. There was some evidence this year of candidates trying to give justification for their responses, particularly in relation to cost and speed of production. It is also worth noting that *different* responses will be required for each part of a question; offering the same response for two parts will not normally gain credit for both.

Foundation paper candidates' knowledge of basic techniques was in many cases quite thin. In the question on soldering technique a number of candidates had ignored the given statements to be inserted and had made up their own. The sequence offered in responses rarely started with tinning the soldering iron; however the majority of candidates gained at least one mark for placing two stages in the correct order.

General improvement in the answering of calculation based questions has continued following the decision to print the required formula within the question rather than in a separate Formulae Sheet. Candidates should be reminded that correct substitution into the formula will gain a mark even when the final answer is incorrect. They should also be aware that use of a calculator in this examination is allowed and indeed recommended.

In the Higher paper a printing error in question 3 resulted in the diagram for the 4001B having an incorrect pinout. The marking scheme for this was adjusted to give full credit to either those candidates who had taken the diagram at face value or those who knew the correct version and had answered accordingly.

The question on an amplifier / driver circuit for a relay in the Higher Tier proved difficult for many candidates; the required response was for a transistor amplifier, either a single transistor or a Darlington pair was accepted. A large number of candidates failed to add any components to the drawing and simply connected the IC output to the relay. A minority of responses featured a transistor, thereby gaining a mark, but correct connection of the transistor was rare.

PAPER 3 FOUNDATION

Question 1

(a) (i) The opening question resulted in good discrimination between candidates. The microphone being the most frequently identified correctly. There were a surprising number of errors on the LDR. This question was attempted by the vast majority of candidates, most of whom gained marks.

(ii) The NTC thermistor was recognised by most as being the heat sensing component, including those who had identified it incorrectly in the previous part.

(iii) There was a wide variety in response to identification of the cathode in a photodiode. A number referring to length of leg, this reinforces the instruction on the front cover to read each question carefully; the question stated that legs were the same length.

(b) (i) There was a slight majority in favour of the correct choice, the 7/0.2mm multistrand wire.

(ii) A large number of sensible responses that gained the mark. Those that referred to an incorrect choice in the previous part still gained credit for a good reason for their choice.

(iii) The insulating property of the sleeving was widely recognised as was the support to the joint. A few responses correctly noted that colour could be used to identify a wire or that the resulting joint is far neater.

Question 2

(a) (i) Response to this part of the question was mixed. As noted in the introduction there were a number of candidates who had made up their own statements rather than using the given ones. In general the sequence involved in the soldering process was not fully understood.

(ii) The toxic nature of lead was widely recognised but there was some confusion concerning the nature of fumes given off, fumes from flux were cited although it was the fumes from lead oxide which can result in lead poisoning. The majority of responses gained a mark for this question.

(b) (i) A large number of correct responses for the multimeter setting. There were two possible settings to gain the mark, ohms or continuity.

(ii) Those candidates who had completed a circuit gained one mark for this. For the second mark the diode had to be correctly orientated.

(c) The choice of the cutters for trimming legs was invariably correct.

(d) A large number of candidates recognised the permanent nature of soldered joints. Rather fewer noted that screw terminals allow rearrangement of wires in addition to being easily connected. The straight pin connector was the only method not requiring any tools once the connector and pins had been fitted; however in terms of initial fitting it is probably the most time consuming.

Question 3

(a) (i) Answered better than previous calculation questions in the Foundation Tier. Substitution errors were common, particularly forgetting to multiply by the supply voltage. Those who substituted correctly normally completed the arithmetic correctly.

(b) (i) The candidates who used the pin references in describing changes E.g. *move A16 to A15*, invariably gained marks. There were a lot of very general changes suggested, such as *turn the LED* round or *move the resistor*. This is not clear enough to gain a mark.

(ii) The initials ‘dil’ were not widely recognised and a lot of guesswork ensued. To gain the mark the full ‘dual in line’ was required.

(c) (i) The two relay connections were not well understood. A lot of responses had connections going back to the transistors or the relay coil. Of those who did gain marks rather more had the normally open to motor connection correct.

(ii) The purpose of the Darlington transistor was not well understood.

Question 4

(a) (i) This part of the question discriminated well. Those candidates who had read the question offered sensible answers that invariably gained marks. Different users for each style were expected.

(ii) Understanding on tolerance was generally good with correct answers being common.

(iii) Clear understanding of minus tolerance shown, particularly by those who had the previous part correct.

(b) There were many responses to this part which reflected clear teaching on levels of production. Understanding of the benefits of a CAD generated parts list for ordering was more widely recognised than the stock control / inventory aspect.

(c) (i) Ease of replacement was a widely recognised advantage with the testing of the boards being noted in fewer responses.

(ii) Economic reasons were the most common response for not repairing a board; very few mentioned the difficulty in fault finding on a complex board.

Question 5

(a) (i) The brightness of the LED display was the most common correct reason for its use; rather fewer giving robustness or use in dark conditions.

(ii) There were fewer correct responses for the LCD; although a significant number recognised the lower power requirement when compared to an LED.

(b) (i) The nature of the injection moulding process was well known with many of the benefits for a high level of production being recognised. Where cost is given it is important to justify the response. Saying that the process is ‘cheap’ is not enough; a better response would be ‘it is cost effective when used for high volume production’.

(ii) The property required referred to flexibility in order for the clip to function. As with the previous part, single word answers are not enough. If the correct name for the property is not known candidates can describe the property and gain the mark, E.g. ‘the plastic needs to be bendy to allow the clip to fit into the housing’.

(c) (i) Orientation was the reason for the notch in the key.
Many incorrectly thought that it was to allow the key to be levered out.

(ii) This part produced some very good responses showing clear design thinking. Reduced cost of assembly and reduced time spent in assembly being the most common areas given.

(d) A lot of confusion here as to what is a conductor and what is an insulator. Too many candidates referred to the risk of electric shock being reduced. Better responses referred to reduced wear on contacts and increased reliability of the switches.

PAPER 04 HIGHER

Question 1

(a) (i) The majority of candidates gained marks on this part. A range of potential users of the drawing styles was accepted but different users for each style were expected.

(ii) A high number of correct answers for this part; a few lost the mark by using centimetres as the unit against the answer. Candidates should be reminded that the millimetre is the unit of measurement used in all questions unless stated otherwise.

(iii) Rather fewer candidates gained the mark for understanding the implication of a minus tolerance.

(b) Higher Tier candidates did rather better on this part and many showed a clear understanding of the way that the JIT system / philosophy operates.

(c) (i) Quality control advantages, particularly those related to easy replacement of faulty units were well understood. The implications for testing individual units prior to final assembly were understood by a minority.

(ii) Most responses centred on the cost aspect with replacement boards being more economical than attempts at repair. The actual difficulty of repair and of fault finding with a high density of components was not often mentioned.

Question 2

(a) (i) A spread of answers for this part mainly centred on the range of colours available with LEDs and the brightness in comparison to LCD displays.

(ii) The major benefit of having far lower power consumption was not widely recognised. The range of shapes and different characters that can be produced was the area that gave most marks.

(b) (i) Knowledge of the injection moulding process was widespread. Some confusion on the details of it but the majority gained at least one mark. The question was a good discriminator.

(ii) The property required referred to flexibility in order for the clip to function. As with the previous part, single word answers are not enough. If the correct name for the property is not known candidates can describe the property and gain the mark, E.g. ‘the plastic needs to be bendy to allow the clip to fit into the housing’.

(c) (i) When being assembled the keyboard needs the keys to be correctly orientated, the notch in the key located on a pillar in the casing ensuring each key is correctly located. A common error was candidates stating that the notch was to assist in removal of the key.

(ii) Candidates showed some clear thinking here and a number of suitable reasons for reduction in parts count were given. A few candidates gave the ease of recycling or increased reliability.

(d) A lot of confusion here as to what is a conductor and what is an insulator.
Too many candidates referred to the risk of electric shock being reduced.
Better responses referred to reduced wear on contacts and increased reliability of the switches.

Question 3

(a) (i) Stages in producing an accurate time delay could have included testing against a known time interval; however the majority of marks came from the choice of resistor / capacitor combination.

(ii) Knowledge of PIC devices is more common now than it once was. A significant number of candidates gained the mark for giving a functional advantage of the PIC controller.

(b) (i) Two marks were available for this part, one for the logic level after the input signals were combined and one for the inversion of this result. A far higher number gained the mark for inversion than for the combination of signals.

(ii) As stated in the opening paragraph the pinout diagram was inaccurate. Despite this the majority of candidates who attempted the question gained marks on it. Adjustment to the mark scheme ensured that no candidate was penalised. Any of the available gates could have been used but the majority chose to use the left hand pair to deal with the initial inputs and the lower right gate for the inversion. In questions of this nature candidates are advised to use the nearest gates to the points that will provide input.

(c) The question required a signal to be amplified to operate a relay. There were few totally correct solutions given to what was simply a single transistor or Darlington driver circuit. Those who inserted a transistor gained a mark. The second mark was for correct connection to the relay and use of a reverse biased diode.
The ULN 2803 Darlington array could have been used for this purpose and would have simplified the circuit diagram; base resistor and diode being integral in the IC.

(d) There were a number of confused responses to this part. Suitable answers would have been double insulation, earthing, or prevention of water from entering the circuit area. Too many candidates were too general in their response and failed to pick out the main dangers.

Question 4

(a) (i) The question was intended to test knowledge of binary notation as well as understanding of the action of a counter. A minority of candidates gained the mark for the output of the 4516B. After 5 pulses it will be indicating 5 on the outputs, i.e. 0101. Those who had attempted the question and failed to gain a mark frequently had the outputs set to 1010. The outputs for the 4017 go high in sequence; after 5 pulses out 5 is set to high or logic 1 and the remainder to low or logic zero.

(ii) There were a number of responses that could have been offered but the most advantageous is the fact that the IC will count down as well as up. Very few candidates saw this as being an advantage; the fact that it also capable of a higher number count was accepted. The major advantage of the 4017 is in the linear outputs which require no decoding for the user. An alternative reason was the fact that a count up to nine fitted the nine minute requirement of the circuit.

(b) The connection to reset with two different level signals coming from a common source provided good discrimination. A number of candidates gained the mark for connecting the inverter output to the counter IC reset but rather fewer gained the second mark for taking the non-inverted signal to the astable reset. A common error was to short the power supply by connecting the inverter output to both supply rails. This solution gained no marks whereas the inverter output taken to both resets gained a single mark.

(c) More able candidates were able to see that by connecting output 0 confusion could be caused by the user thinking that the first time interval had passed.

(d) The breadboard connections provided good discrimination with most candidates gaining at least one mark from the three. A relatively high number gained all three marks. The two connections to 0V could have been completed by connecting to either of the IC 0V pins; a number of candidates did this.

Question 5

(a) (i) The first mark in this part was for understanding that a diode has a blocking / one way effect. Despite confusion with preventing back emf a good number gained this mark. The second mark was for understanding that the signal was being allowed into more than one PIC input pin. Few correct responses were seen for this second mark.

(ii) This part of the question was looking at the number of combinations available in a 3 input gate or more simply in a 3 bit count. Correct answers were in the minority with many candidates omitting to count the 000 combination.

(b) (i) The PCB layout was well answered. It highlighted those candidates who had practical experience of completing a layout rather than relying on auto routing. The experienced candidates simply connected the points to the nearest correct track; others with less experience routed their track more literally from start point to finish point. Either method if it worked gained the full mark.

(ii) With auto routing software now being so prevalent it was no surprise that the majority of candidates knew the variables that could be applied when converting the circuit.

(c) This part of the question focused on smart materials and a number of good answers appeared to gain the mark. Any application where variable resistance is used as part of a sensor was acceptable. Qualified uses as replacement for other types of switch was also awarded the marks.

(d) The final question on the paper produced some excellent responses though there were a few candidates who dwelt on the toxic effects of lead rather than problems in enforcing the ban on leaded solder.

1957 / 05 & 06 – Pneumatics

General Comments

In general the standard of written responses was the same as in 2006. However, there were some written responses that were very difficult to read, especially Foundation Q3 and Higher Q4. Some candidates failed to gain high marks for drawing / sketch responses. Questions referring to mounting brackets for operating cylinders and the joining of piston rods to operating links, are intended to reflect the activities candidates should have experienced through their own designing and making lessons.

PAPER 05 FOUNDATION

Question 1

(a) Sections **A** to **E** were generally well done. Some candidate drawings for **C**, the double acting cylinder, omitted two ports. Some candidates drew an elongated circle for the reservoir but many had omitted to put in the lines for connecting up.

(b) Only a few candidates described correctly that a reservoir could be used to store air or smooth a supply.

Question 2.

(a) (i) Many candidates failed to draw in the air lines correctly from **C** to **B**.

(ii) Many candidates drew the symbol for main air and exhaust correctly, but failed to draw these symbols in the correct positions.

(iii) Most candidates named component **C** correctly as a shuttle valve.

(b) (i) Most candidates named component **D** correctly as a single acting cylinder.

(ii) Most candidates recognised component **E.** Unidirectional flow restrictor and flow control valve were acceptable names.

(iii) Many candidates said it restricts the airflow. A few candidates included adjustment in their answer.

Question 3 This question was generally well answered.

(a) (i) Many candidates recognised that air would flow through component **B** and outstroke the cylinder **C**. Very few candidates mentioned that the cylinder would outstroke slowly because of the action of component **B** despite getting its name correct in the previous question.

(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.

(ii) Very few candidates stated that the air passes momentarily into the system but returns quickly. This will give the effect of a very small movement or ‘shudder’.

(b) Most candidates described the increase in speed of component **C**.

Question 4
This question was generally well answered. Some candidates had difficulty in distinguishing between using CAD to draw and using computers to simulate testing a design for a pneumatic system.

(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 failed to state where computers ***control*** pneumatic systems, such as: fairground rides, film sets & special effects, robots and assembly machines etc.

(d) Many candidates recognised that the change would mean a smaller workforce and a workforce who were trained in IT skills. Redundancy, more skilled workforce, cleaner working environment also scored marks.

Question 5
Most candidates gained 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. A locknut to stop the connector coming off the threaded piston rod was generally omitted. Most candidates drew a central pin to connect the two links together. Some candidates showed connectors that were welded together, preventing any movement of the links. The published Mark Scheme gives an exemplar response that could be used to show future candidates.

(b) Most candidates drew a solution that would hold the operating valve 50mm from the wall. Many candidates did not use the 4 x Ø6 holes to mount the valve and drew a design that used the threaded collar. It was not clear from many drawings how the designed bracket was to be fixed to the wall. The published Mark Scheme gives an exemplar response that could be used to show future candidates.

PAPER 06 HIGHER

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

(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) Some candidates failed to state where computers ***control*** pneumatic systems, such as: fairground rides, film sets & special effects, robots and assembly machines etc.

(d) Most candidates recognised that the change would mean a smaller workforce and a workforce who were trained in IT skills. Redundancy, more skilled workforce, cleaner working environment also scored marks.

Question 2
Most candidates gained high 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. A locknut to stop the connector coming off the threaded piston rod was generally omitted. Most candidates drew a central pin to connect the two links together. Some candidates showed connectors that were welded together, preventing any movement of the links. The published Mark Scheme gives an exemplar response that could be used to show future candidates.

(b) Most candidates drew a solution that would hold the operating valve 50mm from the wall. Many candidates did not use the 4 x Ø6 holes to mount the valve and drew a design that used the threaded collar. It was not clear from many drawings how the designed bracket was to be fixed to the wall. The published Mark Scheme gives an exemplar response that could be used to show future candidates.

Question 3
Many candidates scored high marks on this question.

(a) Most candidates gained marks for recognising that the links need to be identical for the bridge to operate without 'jamming' or folding unequally.

(b) Many candidates managed to complete the flow chart with a sequence that would work. Some candidates started with **A** in the first box and some with **C** in the first box. Both solutions were accepted. The sequence of: **C H A G C H D E** scored full marks.

Question 4

(a) A large majority of candidates recognised the symbol for a double acting cushioned cylinder but referred to it as a restricted cylinder.

(b) Many candidates expressed in their own way the function of the cushioned cylinder and how the trapped air in the chamber at each end of the cylinder slows down the speed of the piston at the end of the stroke. Some candidates thought there was literally a sponge cushion inside the cylinder. A small minority said the cushioning was adjustable.

(c) Nearly all candidates knew that using a cushioned cylinder would prevent the bridge from 'slamming' and give it a gentle final descent on the other bank. The cushioned cylinder would also prevent damage on rolling up was recognised by many candidates.

Question 5

(a) (i) Most candidates scored some marks for the calculation. Some candidates failed to put the **F**orce and **P**ressure into the given formula to get the **A**rea. A few candidates completed a calculation that gave an area of 300sq mm but failed to get the final mark for 19.6mm as the diameter. Some confusion was evident regarding radius and diameter.

(ii) Most candidates who resolved the calculation to Ø19.6mm went on to chose Cylinder D correctly.

(b) There were some good answers to this part of the question, with 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 bridge misunderstanding that the diaphragm valve was held in the exhausting mode while the spring was compressed.

1957 07 / 08 Mechanisms Papers

General comments

In both tiers candidates' responses to design questions tend to be limited by poor drawing skills and many candidates seem to expect examiners to complete their answers by imagining what the candidate has left out. Centres are advised to give candidates the opportunity to practice these skills frequently and to encourage them to include details such as pivot points on levers and linkages, and symbols to represent motion.
Candidates' lack of knowledge of technical detail and mechanical components, particularly in the foundation tier is of particular concern.
Candidates would benefit from regular product analysis activities that focus on the individual components, their function within the mechanism and how they are attached to each other.

PAPER 07 FOUNDATION

Question 1

(a) (i) The majority of candidates were able to recognise that additional leverage was required to make the shaft easier to turn. The most common solution being a cranked addition to the shaft. Few candidates were able to give an adequate response to the method of fixing the additional component to the shaft.

(ii) At this level, candidates were given credit if they named a crank that they had drawn as a handle, although teachers should note that the correct technical vocabulary should be encouraged and used when describing mechanical components.

(b) (i) Most candidates were able to select the sprocket as the best component to make a clicking noise.

(ii) There were many good solutions that held the plastic strip in the vertical plane, however the second specification point requiring a stop to prevent the strip from moving in the horizontal plane was often not considered by candidates.

(c) Although the majority of candidates could correctly identify the conversion of motion, few could correctly name the bevel gear.

Question 2

(a) The majority of candidates were able to give two valid reasons for using lubrication.

(b) Most candidates were able to give an appropriate type of lubricant, grease being the most common answer.

(c) Ball bearing was the most frequently given acceptable answer, although of concern to examiners, is the fact that many candidates were unable to give an answer naming such a common mechanical component.

(d) Many candidates were able to gain one mark by giving the generic difference, that of slippage, between chain and sprocket systems and pulley systems; however in order to gain the full two marks candidates were expected to relate their answer to the application given in the question, explaining why slippage is undesirable.

(e) (i) The most commonly given correct answer related to the need to turn the input and output shafts in the same direction. However the idler gear is another common component that many candidates appear to have little knowledge of.

(ii) At this level, candidates who gave 15 as the answer to the calculation were awarded the mark; however Centres are reminded that velocity ratio calculations should be expressed as a ratio.

Candidates are no longer expected to find the appropriate formula from the formulae sheet as this is now given in the question, however this has revealed that many are unable to correctly distinguish between the driver and driven gears.

(iii) It is concerning to note that many candidates appear to have had no experience of the application of gear ratios in determining speed.

Question 3

(a) The ability of candidates to identify the classes of levers remains weak. Only a small number recognised that the effort and load change positions and as a consequence the class of lever changes.

(b) The majority of candidates were able to show a component that would eject the bolt when pushed by the coin and also work in reverse. A further mark was gained by a few candidates who considered a method of retaining the component in the lock. Many candidates failed to address the final specification point which required the addition of springs to return the jaws to the closed position.

(c) The majority of candidates who answered this question revealed a generally poor understanding of ergonomics. Many candidates missed the point of the question and gave environmental reasons why trolley locks are necessary.

Question 4

(a) Most candidates were able to name mechanical systems that are used in shopping centres.

(b) The worm and worm wheel system was correctly identified by many candidates although a significant number incorrectly named the system as a rack and pinion.

(c) There were some good explanations that showed a clear understanding of how a worm and worm wheel operate, however many candidates failed to read the question properly and attempted to explain why cameras are used in shopping centres.

(d) Few candidates could give an adequate explanation that demonstrated a clear understanding of anthropometrics.

(e) Many answers focused on the designing stages for which no marks could be awarded, candidates failing to appreciate that the question asked for ICT systems in use during the manufacturing stages. Although CAM and CNC were accepted by examiners, candidates should have a wider knowledge of ICT in industrial applications than is generally demonstrated in their answers.

Question 5

(a) The majority of candidates were able to give an appropriate material for the corner plate.

(b) (i) Many answers, although focusing on the design of the corner plate failed to specifically address the value of CAD equipment such as in on-screen modelling or the ability to make quick changes.

(ii) Few candidates could give an adequate answer that demonstrated the benefit of using CAM equipment when making the corner plates.

(c) There were many attempts by candidates to design complex machinery that could be used to bend the plates, rather than a simple jig. The responses were generally disappointing considering that candidates are expected to design, make and use simple jigs in their coursework and the question focuses on manufacturing in a school workshop. Few candidates gained more than one mark.

(d) Candidates were hampered in their responses by poor drawing ability and a lack of knowledge of technical detail. The majority of answers consisted of some simple sketches with vague notes that expected the examiner to fill in the gaps. Few candidates considered the need to limit the tilt angle between horizontal and $45^{o.}$

PAPER 08 HIGHER

Questions 1 and 2 are common questions with the foundation tier questions 4 and 5 and generally the quality of responses is noticeably superior.

Question 1

(a) Well answered by most candidates.
(b) Most candidates were able to correctly name the worm and worm wheel.
(c) Many candidates were able to demonstrate a clear understanding of the features and function of the worm and worm wheel including fine control of movement and high torque.
(d) Good answers included the ability to use data when designing to increase comfort and reduce strain injuries.
(e) As was the case in paper 7, misreading of the question resulted in candidates giving responses that related to designing rather than manufacturing. However, at this level, good answers showed a wider appreciation of industrial applications including quality control and logistics.

Question 2

(a) The majority of candidates suggested steel or aluminium.
(b) (i) Virtual reality modelling and adjustment of designs were commonly given examples for the use of CAM.
(ii) The use of CNC machinery to enable parts to be repeated with consistent accuracy was the most frequent response.
(c) The majority of responses were disappointing indicating little understanding of what a jig is.
(d) Although there were some better responses to the design of the camera bracket, generally candidates at this level display a similar lack of ability to provide adequate detail in their drawings as do the foundation tier candidates.

Question 3

(a) Although the majority of candidates were able to show a crank and connecting rod or a pulley and belt, many failed to include a pivot on the arm, about which, the phone would oscillate. The most common solution to the need for a delay was the use of a cam, driven by the pulley and belt; candidates who used this solution clearly demonstrating an understanding of the dwell.

(b) Producing flow charts is an essential part of technical vocabulary and clearly many candidates have a good understanding of how to use them, including the application of feedback loops. However, a significant number of candidates appear to have had no experience of using them and Centres are advised to encourage candidates to describe processes, work schedules and systems in flow chart form.

Question 4

(a) Good responses to this question included reference to quiet operation and the ability of the belt to slip if the movement of the sign is restricted.
(b) Candidates who calculated the velocity ratio correctly but failed to express the answer as a ratio were awarded one mark only.
(c) The majority of candidates were able to correctly name the bevel gear.
(d) Few candidates were able to complete the calculation for the velocity ratio in the gear box. Marks were awarded for correctly completing parts of the calculation. Centres are advised to give candidates the opportunity to practice the use of formulae.
(e) (i) Candidates who did not express their answer as a percentage could not be awarded the mark for their efficiency calculation.
(ii) The majority of candidates were able to correctly suggest friction as a reason for reduced efficiency.

Question 5

(a) (i) The majority of candidates were able to choose the correct bearing.

(ii) The names of the bearings was generally well known even when the incorrect bearing had been selected in part (i).

(iii) Although the majority of candidates were able to give a general reason for the use of lubrication, for which they were awarded one mark, at this level, in order to score two marks, the answer needed to be related directly to the shopping trolley and the environment in which it is used.

(b) There were some good, well thought out solutions that addressed all of the specification points. However many answers amounted to nothing more than a number of unrelated shapes with vague comments that invited the examiner to imagine the links. Frequently, some potentially good solutions, showing what appeared to be a system of levers and linkages failed to include pivot points or indication of motion.

1957/09 – Internal Assessment

General Comments

2007 was a year of contrasts with some centres continuing to produce excellent work, while other centres produced incomplete work.

There is still little of the INPUT-PROCESS-OUTPUT model being used, as stated in last years report. It is good to see that candidates are dividing folders into sections and schools are using the full breakdown of the mark scheme. The improved organisation is helping candidates produce concise folders making the moderation procedure run smoothly.
Some centres are still setting the same theme for all candidates, which although supporting lower ability candidates, limits the use of the mark scheme as many candidates produce nearly identical folders.

Objective 1: Identification of a need or opportunity leading to a Design Brief

Generally good work produced with candidates tuned into the commercial approach, where they should be thinking of the customer and client. Problems are developed from a need seen by the candidates.

Objective 2: Research into Design Brief leading to a Specification

In fully identifying the problem the candidate should be clear who is the customer and gather relevant data. The survey should aim to gather information about the product need and what the customer wants. Many sets of results are seen with graphs and charts but the real importance are the conclusions drawn from the data.

Other necessary data would include specific components or sizes from the problem which must be considered.

When looking at existing products the work must be more than ‘‘scissor research’’ pasting pictures with little or no comment. A full product analysis should be carried out. Use of headings with user criteria, manufacturing criteria, environmental criteria, gives a complete analysis of the product. Two products with good analysis would give candidates a good understanding.

All this research work is now connected with a conclusions page which would gather together all the important points to be included in the specification.

The last section must detail all the requirements for a successful design. A good specification will have similar sections to the product analysis, and should certainly include some comment about the user. A batch production comment would ensure the candidate is thinking of the commercial possibilities.

Objective 3: Generation of Ideas

Candidates often propose ideas that focus on the product casing and not on the circuit or system which is the function of the design. The project should be about developing a marketable product and all aspects of the product need to be considered. In the best cases candidates generate ideas for the system and its casing, with annotation which describes function, materials and construction.

An appraisal criticises the design, considering function and the customer. A reasoned choice is needed for a product to be developed.

Communication was variable. The best candidates were able to mix a range of freehand sketches with rendering and use of CAD drawings with various styles and rendering.

Objective 4: Product Development

The final selected design needs to be clear, then exploration of the design can take place. Modelling still needs to be further encouraged, with trialling and testing recorded digitally. Comment need to be made relating to need and the customer for improvements to be made.

Greater number of possible construction techniques need to be analysed in the folder, adding comments on pros and cons of each material and technique. Development for manufacturing is as important as the idea.

For electronic projects more thought should be given to the layout of components with PCBs being clearly improved and developed. The secondary problem of internal layout of PCB with the additional controls in the casing should be clear but was rarely completed.

There are a wide range of CAD packages to support the work of candidates and where possible these should be used to help show the completed design ready for manufacture.

Batch production of the project must be considered with a control system for production. This could be in the form of a template, PCB mask, moulding for forming, certainly there are many opportunities where the candidate could state the system.

Objective 5: Production Planning and Realisation

The planning for production has been generally improving, with many examples of frameworks including, processes, health and safety, quality assurance and often time predictions. Good flow charts were seen as Gannt charts or sketch flow charts. Centres are now realising evidence is needed to gain the full marks.

It is useful to see a log of manufacture, especially as examples of how the candidates completed the work, but it does not replace the planning section.

Centres do need to recognise the candidate does have to make a prototype of a marketable product with a quality outcome, fully functioning for the highest mark ranges.

Some centres assess work in this section at a high level when the product is little more than modelling and not functioning suitable for the customer. A lower band would be more appropriate.

Objective 6: Evaluation and Testing

Generally improved with appraisals made using a detailed specification as the leading measure of the product. In the worse cases candidates make unsupported statements about their products. In the best cases there is evidence of active testing and trialling, comparison to the specification and recommendations for future improvements.

Many candidates are failing to comment on the use of the control system for production. It is imperative the control system is used in the making of the product then the candidates can make judgements for the future use of the system.

Presentation

Most centres are now comfortable with the award of the mark for the overall presentation of the project. Rarely is it misused as a bonus mark.

General Certificate of Secondary Education

D&T Systems and Control (1957)

June 2007 Assessment Series

Component Threshold Marks

Component	Max Mark	A	B	C	D	E	F	G
1	50			31	26	22	18	14
2	50	28	23	18	13			
3	50			23	19	15	12	9
4	50	25	19	14	8			
5	50			32	27	23	19	15
6	50	36	31	27	22			
7	50			27	22	18	14	10
8	50	32	27	23	18			
9	100	85	74	63	51	39	27	15

Specification Options

Foundation Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				98	81	64	48	32
Percentage in Grade					20.51	29.14	22.61	13.29	7.69
Cumulative Percentage in Grade					20.51	49.65	72.26	85.55	93.24

The total entry for the examination was 429

Higher Tier Electronics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	135	118	101	85	66	56		
Percentage in Grade		7.76	22.55	30.55	22.32	11.46	2.39		
Cumulative Percentage in Grade		7.76	30.31	60.86	83.17	94.63	97.02		

The total entry for the examination was 838

Foundation Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				98	81	65	49	33
Percentage in Grade					17.88	23.38	23.58	19.45	8.45
Cumulative Percentage in Grade					17.88	41.26	64.83	84.28	92.73

The total entry for the examination was 552

Higher Tier Mechanisms

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	140	124	108	92	73	63		
Percentage in Grade		10.03	20.05	25.00	24.22	16.93	2.47		
Cumulative Percentage in Grade		10.03	30.08	55.08	79.30	96.22	98.70		

The total entry for the examination was 768

Foundation Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175				107	89	71	53	35
Percentage in Grade					26.67	16.67	30.00	23.33	3.33
Cumulative Percentage in Grade					26.67	43.33	73.33	96.67	100.00

The total entry for the examination was 33

Higher Tier Pneumatics

	Max Mark	A*	A	B	C	D	E	F	G
Overall Threshold Marks	175	134	121	108	95	76	66		
Percentage in Grade		12.12	9.09	34.85	30.30	10.61	1.52		
Cumulative Percentage in Grade		12.12	21.21	56.06	86.36	96.97	98.49		

The total entry for the examination was 66

Overall

	A*	A	B	C	D	E	F	G
Percentage in Grade	5.68	13.22	17.84	21.97	18.26	10.08	6.17	2.92
Cumulative Percentage in Grade	5.68	18.90	36.74	58.71	76.97	87.05	93.22	96.14

The total entry for the examination was 2799

Statistics are correct at the time of publication.

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

OCR Customer Contact Centre

(General Qualifications)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Telephone: 01223 552552
Facsimile: 01223 552553