CONTENTS

FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned**.

UNIVERSITY of CAMBRIDGE
International Examinations

DESIGN AND TECHNOLOGY

GCE Advanced Level and GCE Advanced Subsidiary Level

Grade thresholds taken for Syllabus 9705 (Design and Technology) in the November 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 1	120	73	66	37
Component 2	40	32	28	16
Component 3	120	87	80	47
Component 4	40	34	28	16

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

Grade Thresholds are published for all GCE A/AS and IGCSE subjects where a corresponding mark scheme is available.

Paper 9705/01

Written

General comments

The performance of candidates was very mixed and ranged from poor to the very good. It was evident that in some cases candidates had only a limited knowledge and understanding of the subject matter that they had chosen to answer. This was particularly true with some production processes and manufacturing techniques.

The questions on the examination paper require candidates to respond in a variety of different ways, for example, using short sentences, detailed explanations and annotated sketches. It is important that whichever method is used candidates make their answers as clear as possible and relate their responses to the number of marks available. Candidates would be well advised to look carefully at the number of marks available and structure their answers in such a way that the content reflects that mark.

Some candidates are spending too much time on questions which carry a low mark while others are producing superficial responses to questions which have higher marks. Answers must be focused in a way that responds fully to the question being asked.

Candidates should read through each question carefully before they start their answer. They must make sure they are clear about what the question is asking them to do. Some candidates lost marks because they misread or misunderstood important words in the questions.

When answering questions it is important that candidates make sure that they apply their subject specific knowledge and understanding rather than general knowledge.

In ***Section B*** a good number of candidates used too much continuous text in their answers to the questions. In a few cases candidates did not produce any sketches at all.

Instructions on the front of the examination paper draw attention to the statement ‘discuss’ within a question. While in some cases discussion was well presented in ***Section C*** with clear supporting arguments made, in a good many cases there was evidence to suggest that candidates had not taken sufficient notice of this instruction.

A few candidates failed to answer the required number of questions. A higher number missed out parts of questions.

Comments on specific questions

Section A

Question 1

(a) A good proportion of candidates correctly stated that clockwork needed to be converted to electrical energy in order to make the radio work.

(b) Candidates were asked to 'explain two reasons'. While many candidates were able to 'state' two reasons why clockwork is a good energy source for a radio which is to be used in remote parts of the world, far fewer offered any explanation and therefore failed to gain the second of the two marks available for each explained reason.

(c) Most candidates were able to state at least one other appropriate, alternative energy source that could be used to power a radio. Correct answers included mains electricity, batteries and solar power.

Question 2

While the vast majority of candidates listed at least some appropriate factors that could form part of the design specification for the storage device a good number failed to focus their responses around the three given areas of size, safety and ease of use. A number of candidates repeated the same factor using slightly different words. In a limited number of cases, candidates carried out a product analysis of the holder rather than listing factors for a design specification.

Question 3

(a) Most candidates showed at least some understanding of the injection moulding process. However, some offered a description of the process rather than focusing their response on the question being asked. Answers needed to relate to aspects such as the pressure is maintained for a short time (the dwell time) to prevent the material creeping back during setting. This prevents shrinkage and hollows and therefore gives a better finish. Or the mould is warmed before injecting and the plastic is injected quickly to prevent the plastic hardening before the mould is full. These aspects result in consistent accurate dimensions and a high quality surface finish.

(b) Correct responses were generally those that related to the high costs involved in producing the moulds and setting up the machinery. The process is therefore uneconomic for short production runs.

A number of candidates stated reasons but failed to explain them.

Question 4

(a) In their responses, many candidates were able to give appropriate reasons why many people prefer to buy home-assembled furniture rather than ready assembled furniture. These reasons usually related to the furniture being cheaper and easier to transport. Most, however, failed to explain *why* it was cheaper or easy to transport.

With questions of this type it is important that candidates do explain their reasons otherwise they do not have access to all of the available marks.

(b) Some very good answers were seen, but a good proportion of candidates attempted to design very complex ways of joining the shelf to the frame of the trolley. A good number of these designs were not totally appropriate because they only enabled the shelf to 'rest' on the frame rather than join the two parts securely together. A nut and bolt was the simplistic solution to the problem.

Question 5

(a) The majority of candidates stated the name of an appropriate wood, teak being the most common correct answer given. The wood's suitability had to relate to its ability to resist adverse weather conditions rather than factors such as 'it is commonly available'.

(b) A good number of inappropriate methods were given as to how the shape of the post could be produced. It was common for candidates to suggest that the required profile could be achieved using a tenon, or other form of hand saw and a file. The better answers described how an electric router or circular saw could be used to produce the required cross section. A good number of candidates spent far too long on this part of the question, producing up to four sides of A4 yet still only gaining half of the marks available.

(c) Very poorly answered with most candidates doing little more than repeating the information given in the question. Most responses lacked any real detail about 'how' the two processes would be carried out. It was rare for candidates to give information about computer software or the specific machinery that would be used.

Section B

Question 6

(a) Most candidates named an appropriate metal for making the trolley and were able to explain at least one appropriate reason for their choice. For example, mild steel tube because it would be lighter in weight than solid steel and be easy to join.

(b) Frequently answered at a very superficial level with many candidates using far too much continuous text. Some candidates incorrectly suggested that the frame for the trolley could be cut from one sheet of metal.

While tools and equipment were sketched their use was often very poorly described. Statements such as 'The metal would be marked out with a scriber' were common but candidates frequently failed to *describe* how the process of marking out would be done.

While a good number of candidates correctly identified welding as being a way of joining the frame together few gave any real details about how this would be done. One poorly annotated sketch was all that some candidates offered as their description of the process.

In their responses to questions of this type, candidates should use a series of annotated sketches to describe clearly, stage by stage, how the required process would be carried out. It is not sufficient just to list and/or draw the tools etc. The candidate must describe *how* they would be used.

(c) A number of candidates failed to answer this part of the question. Those that did attempt it generally presented good responses. Paint was the most common suitable finish given with candidates explaining that it would protect the trolley against corrosion.

Question 7

(a) Many candidates failed to relate their choice of wood to the material's suitability for lamination or steam bending. In questions of this type it is important that candidates consider the intended use of the material before they make their choice.

(b) Most candidates were able to specify a suitable plastic such as acrylic or polystyrene, fewer were able to explain a suitable reason for their choice.

(c) A limited number of candidates incorrectly suggested that the end supports could be made from either a single piece of wood or three separate pieces. The majority of candidates, however, understood that the curved shapes need to be achieved either by lamination or steam bending. A good proportion of candidates correctly suggested that the three pieces of the frame could be joined using dowel joints, halving joints or mortise and tenon joints. Stating that the frame could be 'glued together' only gained limited credit. The most appropriate way of attaching the plastic sign to the frame was to use a groove or rebate. These methods were suggested by only a limited number of candidates with many stating 'they could be glued'. Again only limited credit was given for this response.

As with **Question 6**, answers were often at a superficial level with candidates frequently offering only limited descriptions of how the appropriate tools and equipment would be used to carry out the required processes.

Question 8

(a) Most candidates had at least some idea of the shape that would need to be marked out on a flat sheet of plastic to make the cassette tape storage rack. Common errors were to produce a three dimensional drawing, to draw the wrong number of slots and to make the drawing the wrong size.

(b) Most candidates stated the name of an appropriate plastic that could be used to make the storage rack. Appropriate plastics included acrylic and polystyrene.

(c) The majority of candidates were able to explain at least one advantage of using plastic rather than wood for the storage rack. Suitable advantages included, plastic is easier to bend, plastic is already coloured, plastic has a better surface finish and plastic is easier to keep clean.

(d) Most candidates showed that they had at least some understanding of both processes. The most common error was to suggest that the drilling machine could be used to remove all of the material from the slots rather than to just drill holes at the end of the slots. In part **(ii)** some candidates only explained safety issues linked with one of the pieces of equipment rather than both.

As with **Questions 6** and **7**, answers were often at a superficial level with candidates frequently offering only limited descriptions of how the appropriate tools and equipment would be used to carry out the required processes in a safe manner.

Section C

Question 9

(a) Most candidates were able to identify the parts of the product where the various types of motion would occur. Some used sketches and notes to explain how the different motions were produced but many failed to fully explain the effects that the various motions had on the cork. Candidates should have used a series of annotated sketches to explain stage by stage how the corkscrew would be used to extract a cork from a bottle. The explanation needed to include how the various parts of the corkscrew moves as it is used and what happens to the cork at each stage. In some cases candidates tried to explain the whole operation using a single sketch.

(b) A good number of candidates correctly identified the mechanism as a rack and pinion. The quality of sketching used to show how the mechanism worked varied. Some candidates did no more than copy the drawing given on the question paper while others produced more detailed sketches which clearly showed how the two parts of the mechanism meshed together to change one type of motion to another.

(c) Many candidates were able to identify potential hazards, but fewer offered any real level of discussion of the hazards or used evidence to support their conclusions.

Question 10

(a) Almost all candidates were able to identify at least one appropriate material. It was important that the material named was suitable for making a chair. In some cases, candidates named thermoplastics and non-ferrous metals but failed to gain the marks because the named material would not be appropriate in the required situation. For example, a chair made from gold.

(b) Only a limited number of candidates showed that they understood that fabricated meant that a product was made from a number of separate parts which were joined together. More candidates understood that injection moulding involved forcing liquid plastic into a mould and that casting involved pouring molten metal into a mould. In a limited number of cases candidates just repeated the question. For example, 'Injection moulded means that the chair is made using injection moulding'.

(d) Candidates were given criteria against which to discuss the advantages and disadvantages of the three chairs. Some candidates did little more than list the advantages and disadvantages not just in relation to storage and maintenance but a range of other issues such as appearance and safety. This is a case of candidates not reading the question carefully enough. Few candidates offered any real discussion about the advantages and disadvantages of the chairs or used any evidence to support their conclusions.

Question 11

(a) The majority of candidates were able to name suitable materials and surface finishes that could be used in the manufacture of the computer workstation.

(b) This part was frequently poorly answered with a good proportion of candidates failing to relate their answers to an explanation of why manufactured board is a more *stable* material than solid wood. Some would seem to have read the word *stable* as *suitable*.

(c) This was generally well answered with a good proportion of candidates explaining that tubing would be lighter than solid bar and would therefore make it easier to move the workstation.

(d) A good number of candidates answered this part from the viewpoint of the customer rather than the manufacturer. Answers needed to relate to reduced labour costs because the furniture did not have to be assembled and the fact that less storage space was required.

(e) Some good answers were seen with a good proportion of candidates explaining that this enabled the furniture to be assembled and dis-assembled as and when required by customers.

(f) Many candidates listed factors rather than discussed them. Some even started to suggest how the design could be improved. While most candidates produced at least one diagram, many failed to make full and effective use of them. They frequently failed to offer any real discussion about the ergonomic factors that the designer would have needed to consider when designing the computer workstation or to use any evidence to support their conclusions.

Paper 9705/02

Coursework Project 1

General comments

A wide range of projects was presented for moderation and many candidates should be congratulated on the care taken in the production of their work. Clearly, many became engrossed in their Design and Technology project and developed a sound understanding of the chosen area of study. Some work was of an extremely high standard and in line with expectations for Design and Technology at this level of examination. Notable products, in addition to the normal range of furniture and other household items, included: vehicle bicycle rack; wine storage system; greenhouse; art gallery design; dyslexia awareness campaign; heavy object mover; luggage loader; hospital bed; tape measure; water feature; outdoor sleeping; wheel clamp; water storage; vegetable oil press and a range of architectural models of buildings. Some of these products reached the prototype stage whereas others, because of their nature, could only be presented in the form of a model.

The work was generally presented well and design folders were easy to follow. This is helpful to the Moderator as the basis on which the assessment has been made can be seen clearly. Centres are reminded of the need to include clear and detailed photographs of the models produced by candidates for Project 1 9705/02 and final products for Project 2 9705/04. If this is not done then moderation of this section of the assessment scheme cannot be carried out.

Centres have obviously taken note of previous comments and, generally, folders were structured such that they reflected the order of the assessment criteria. Where this had been done it was clear to see how a candidate's thought processes had developed and, generally speaking, the work was of a higher standard as candidates had covered all aspects of the assessment scheme.

The Moderator would like to thank Centres for the care taken in the administration of Centre based marking and the submission of work and all documentation for moderation.

Comments on individual assessment criteria

Identification of a need or opportunity leading to a design brief

The design situation was expressed clearly by most candidates but a detailed description of the user was not always included. Only when both are included as parts of a clear and precise design brief can a clear picture of the design need be identified and full marks be awarded.

Analysis of and research into the design brief which results in a specification

A wide range of existing products was identified by most candidates but these were not always related and linked to the intended situation and user, specified in the design brief. This section should not include irrelevant information such as the history of products. Similarly, information on components, materials and constructions should not be considered before ideas have been generated and appraised. This information should be considered as part of Product Development in Project 2 (9705/04).

Many candidates made the common error of simply giving illustrations or descriptions of existing products, often with vast amounts of copied technical detail. For the award of high marks, detail of existing products must be analysed and evaluated in the context of the situation and user stated in the design brief. It is only when this detail is carried forward and then referred to in the generation of ideas that the candidate can give a clear indication that genuine design thinking is taking place.

Candidates who identified and collected data by working through the purpose of the intended product, step by step, and visualising its use in the design situation then went on to carry out meaningful and innovative design work.

Analysis and research into the design brief must culminate in a detailed specification that has evolved from this work. The specification is often most effective when consisting of a list of specific points that can be easily identified and referenced during the generation and appraisal of ideas. Specifications of a generic nature cannot be accepted for the award of high marks at this level of examination.

Generation and appraisal of design ideas

This is the section of the design folder where candidates can be genuinely creative and explore and record a wide range of ideas however practical or otherwise they may appear at this stage. There is no right or wrong and it is only through the consideration of seemingly impossible ideas that new avenues can be explored. Unfortunately some candidates approach this in a somewhat formal and stifled way simply concentrating on one or two concepts with these often coming, at the lowest level of performance, from existing ideas.

Candidates should be encouraged to include any and all evidence of design thinking whatever quality the drawings may be at this stage. As candidates consider their design ideas they need to show through clear annotation of drawings that they have the specification in mind throughout this stage of the design process. The assessment criterion in the syllabus gives a clear indication of what is expected here.

Modelling of ideas

Candidates do not always make good use of the modelling stage but simply produce a mock up of the chosen design idea, often very close to the final made artefact where this is carried through into Project 2. This stage can be used in an imaginative way to consider one or several aspects of the form, construction or operation of a product design or system.

The model need not necessarily be of a complete product but may concentrate on one or two particular design aspects still to be finalised. Where products include particular mechanisms or structures it would benefit candidates if they included evidence of modelling of these. Successful candidates considered the most appropriate way of modelling these aspects of their design ideas including consideration of suitable materials and construction methods to be used.

Although there was little evidence that they had been used, construction kits can be put to good use when modelling some design features as they can be reused once photographic evidence has been taken. As mentioned earlier it is a requirement of the assessment scheme that photographic evidence of modelling is included in all design folders.

Paper 9705/03

Written

General comments

The numbers of candidates entering for this examination continues to grow. The preparation of candidates for the written paper and the administration of scripts by Centres is most impressive.

Very few rubric errors occurred and the majority of candidates used the full allocation of time appropriately.

Some candidates do not fully complete all elements of the assessment criteria for ***Section B*** and the range of ideas, proposed solution and evaluation are often rushed or missing.

The quality of sketching continues to improve and candidates are very well prepared to describe the stages of particular processes.

The front cover of the examination paper gives candidates clear guidance as to what is required by the instruction ‘discuss’. Most candidates raise a number of issues and explain them well. A large number do not introduce appropriate evidence to support their responses.

In ***Section A***, *Part A* was again the most popular option with **Questions 1** and **3** the most popular. There was an even spread of responses in *Part C*.

Only a few candidates attempted questions in *Part B*.

It would be helpful if this report is read in conjunction with a question paper and mark scheme.

Comments on specific questions

Section A

Part A – Product Design

Question 1

(a) A very popular question, generally answered well. Most candidates stated acrylic as a suitable material for the holder because it is easy to form the required shape and a high quality finish can be obtained, as well as its availability in a range of colours, including transparent. Aluminium was also a popular choice of material.

(b) Although most candidates described the manufacture of the prototype exceptionally well, a number spent far too long on sketches to show every detail of marking out, cutting, forming and finishing. A maximum of four sketches would be acceptable.

(c) Most candidates selected a different material, e.g. ABS and polypropylene, and described an injection moulding process. The best responses gave clear details of the mould required.

Question 2

(a) A number of candidates described general features of the bicycle with very little reference to anthropometric features. The best responses gave details of leg length to provide a comfortable seat height, hand/finger span to effectively operate the brake lever, hand grip diameter for comfortable control of the handle bar and arm reach to decide upon a comfortable distance between seat and handle bars.

(b) The most common ergonomic features explained were grips on the pedals to ensure safety when pedalling and shape and composition of the seat to provide comfort when using the bicycle for long periods.

Question 3

(a) A popular question, generally very well answered. Vacuum forming was well explained although a significant number of candidates did not include details of a former.

Lamination was well described. Some candidates referred to steam bending, which is appropriate when laminating thicker sections of wood. A number did not include the need for a former to hold the shapes whilst gluing.

Very few candidates fully described a die casting process. Many referred incorrectly to sand casting.

(b) A number of candidates did not complete part **(b)** where they were required to explain why the process is particularly suitable for the chosen item.

Part B – Practical Technology

Question 4

Very few candidates attempted this question. Most of those who did attempt it demonstrated a clear understanding of the properties of materials and of testing procedures. Part **(c)** was particularly well answered.

Question 5

Very few candidates attempted this question. Some produced fully detailed responses for both part **(a)** and part **(b)**. Some candidates answered part **(a)** only.

Question 6

There were very few attempts at this question.

Part C – Graphic Products

Question 7

Most responses to this question were of a very high quality. Candidates generally had a clear understanding of how to produce a planometric view and included all required details.

Some candidates incorrectly produced isometric views.

Question 8

(a) Many candidates were able to discuss the implications of the increased use of computers when designing products and included issues relating to speed, quality and effective communication.

(b) With the exception of a few outstanding responses, full of detail and including appropriate examples, the majority of candidates focused on one issue relating to the use of computers in the automation of production lines and job losses. Candidates must examine a broad range of issues when attempting a 'discuss' question.

Question 9

(a) Virtually all candidates used examples to explain the use of pie charts and flow diagrams. Many had an understanding of pictograms and graphs but did not relate them to a way of recording or presenting information.

(b) Exceptionally well answered by most candidates. Some used detailed construction methods which would have taken far too long and were not required.

Section B

This section was answered well by the majority of candidates. Fewer candidates are spending too long on this section. Time management is still a problem for some candidates. Some spent far too long on ***Section A*** and did not fully complete all parts of ***Section B***. A significant number of candidates did not complete a proposed solution and evaluation.

All candidates prepared their answers on A3 paper as instructed.

It is obvious that candidates are given clear guidance on how to approach the design question. Some responses were of an exceptionally high quality, indicating that candidates had used practice papers to enable them to allocate appropriate time to each part and use all of the time available.

Many candidates continue to repeat the given problem in the analysis and specification and do not look at the wider issues involved.

The best responses indicated at least five detailed points of analysis relating to the given problem, other than the main issues given in the question.

Some used scattercharts to present an analysis but in many cases, used generic statements e.g. 'durable', without any further qualification or specific relationship to the given problem.

A number of candidates produce a brief, which is not necessary.

Most candidates were able to produce a list of at least five justified specification points.

Each question provides initial specification points or data. Candidates are expected to produce a list of five other points. No marks are awarded for repeating given data. Generic terms such as 'safe to use' did not gain a mark, 'the mechanism must not allow fingers to get trapped when folding' would gain credit.

Most candidates generated a wide of a range of significantly different ideas and the standard of presentation was generally very high. Most candidates annotated fully, with reference to specification points.

The standard of the development of ideas section continues to improve. Candidates used notes and sketches to develop selected features, clearly showing the reasoning behind decisions. A number of candidates spend far too long producing a lengthy step by step procedure for manufacture. Candidates are expected to make clear the constructional details of ideas leading to a single design proposal.

The way in which candidates evaluated ideas varied. Many evaluated ideas as they progressed, giving clear reasons for selecting ideas to develop. Some produced charts giving qualified ratings of performance for specification points which is acceptable.

Many proposed solutions included overall dimensions but did not include specific details such as the thickness of materials.

In the final evaluation, candidates must make specific reference to their final proposal and state whether the proposal is fit for purpose, referring to specification points where necessary, and suggest improvements or modifications.

A more detailed breakdown of the assessment criteria for ***Section B*** is given in the mark scheme.

Question 10

The most popular question in ***Section B***. Most candidates used their time well and demonstrated sound design thinking skills and high quality presentation. Most candidates produced realistic solutions with a number of exceptionally innovative proposals.

Question 11

Very few candidates attempted this question. Ideas tended to focus on the packaging of the kit. Very few candidates included systems to teach parallel and series circuits.

Question 12

A popular question. Many candidates produced effective display systems for 2D and 3D work. A number of candidates did not consider the need to inter-link the system.

Paper 9705/04

Coursework Project 2

General comments

See Paper 9705/02.

Comments on specific questions

Product development

Many candidates do not make full use of this part of the design process and often simply repeat ideas from earlier stages. They should take the chosen, and modelled, idea from Project 1 and consider all aspects of form, materials, finish, construction and production methods in detail. All information should be linked directly to the chosen idea and, where this is technological in nature, should include details of components to be used.

At this level of examination there should also be clear evidence of meaningful testing and experimentation linked to the ideas being developed. Simply listing materials and constructions with their strengths and weaknesses in textbook fashion is not sufficient and cannot be awarded high marks. The Moderator would like to see more evidence of genuine testing, of any aspect of selected ideas, in design folders.

Having developed their ideas through consideration of alternatives, candidates must give the reasons for decisions made. Unfortunately, in many projects, there was uncertainty as to how the product had developed from the final idea to the artefact produced.

The final part of the development should give all details of the intended design solution. This should be in the form of drawings from which a skilled person could make the model or prototype.

Product planning

It is important that candidates plan the production of their artefact before any work commences. This should include an indication of the overall sequence of operations linked to some form of time plan. There is no need for candidates to give detail or show illustrations of basic tasks but it is expected that the order of events will link to sound practical techniques.

Working drawings and a list of materials and components to be used should provide all the detail required for the realisation of the final product.

Some candidates still produce this section after the product has been completed or simply include photographic evidence of the work in progress. This record or diary of what has already happened shows no evidence of forward thinking. Centres are advised to discourage this approach, as it is really a waste of valuable time and cannot be awarded marks.

Product realisation

Candidates should be congratulated on the high quality of some of the items produced and there was clear evidence that they had become truly involved in the making of their developed designs. It was clear that, in many cases, the artefact matched the requirements of the specification and could be put to worthwhile use.

Many candidates had obviously developed some advanced practical skills and put these to good use in the manufacture of the final product. Other less successful candidates had clearly required more help and guidance from their teachers.

Centres are reminded of the need to include good quality photographic evidence showing overall views of the product together with close up detail showing the quality of work produced. Without this evidence the Moderator is unable to substantiate the marks awarded.

Testing and evaluation

As has been the case in the past, there was greater variation of outcomes between candidates in this section of design folders than in any of the others. This is probably due to what appears to be a misunderstanding of what testing and evaluation is about. It is not an evaluation of the design folder and the problems associated with the making of the artefact but of the success of the product itself. Does it fulfil the design need and requirements as set out in the specification? Nor is it simply a matter of asking friends to complete a questionnaire or to complete a tick box against each of the specification points.

Successful candidates referred to the original specification and commented on the level to which each point had been satisfied. This can only be achieved by practical testing of the product in a live situation leading to the identification of opportunities for modifications and improvement. Critical testing of the required nature can really only be successful where the potential user of the product has been involved. It is expected that this will be supported by a meaningful record of testing activity and/or photographic evidence, where this is possible.

Where candidates have produced a model as their final product then, in most cases, this should be tested and evaluated as a model in its own right and not as the actual product or building. The purpose of the model should be outlined in the design brief and set out in detail in the specification. When this has been done then true evaluation can be carried out.